Electricity market forecasts: 2015

A REPORT PREPARED FOR THE AUSTRALIAN ENERGY MARKET
OPERATOR (AEMO): FINAL

April 2015

Electricity market forecasts: 2015

Contents

Electricity market forecasts: 2015

Figures

Tables

Executive summary

This report presents energy price forecasts for the Australian Energy Market Operator (AEMO). AEMO will use these forecasts to develop its forecasts of electricity consumption for the 2015 National Electricity Forecast Report (NEFR).

In this report three sets of projections are presented: a scenario where energy demand is 'medium' (the base case), a scenario where energy demand is expected to be 'high' and a scenario where energy demand is expected to be 'low'.

Retail electricity forecasts

The Medium scenario for the energy market is based assumptions agreed with AEMO for network costs, energy demand, and supply costs.

Figure 1 shows the Medium scenario for residential electricity prices. It compares estimates of historical residential electricity prices against our projections for each state as a real index.

The following key results are evident.

○ Historically, residential prices had been relatively flat in real terms until around 2007.

○ Prices increased rapidly from 2007-2013, largely due to rising network costs.

○ A further increase is evident in FYe2013, when the carbon price was introduced. However prices also fell from FYe2014 to FYe2015 with the removal of the carbon price.

○ The impact of network costs is highly varied depending on the regulatory timetable. In NSW the AER has released Draft Determinations which include reductions of almost 30% on distribution network service provider (NSP) proposals within the next few years due to lower OPEX and WACC provisions. This is reflected in our Medium case. In other states the AER has not yet released Draft Determinations and so we have relied on NSP proposals (Qld/SA) or assumed continuation of current levels (Vic/Tas). This report does not take a position on the likely outcomes of the regulatory determination process other than most recent information, though this is why NSW retail prices are expected to fall more sharply than other regions. The scenarios consider the possibility that subsequent AER Determinations will apply in other states. This is likely to reflect a lower bound for network costs

○ Currently, wholesale prices are low due to weak demand growth and a ramping up of renewable investment to meet the renewable energy target (LRET). Although wholesale prices are projected to remain relatively weak in

the short-term, they are expected to rise in the longer term due to the following factors:

● As demand eventually recovers, the demand/supply balance can be expected to tighten

● Gas prices are projected to rise over time, contributing to higher generation costs. This is largely driven by the introduction of export LNG markets in the eastern states in Queensland from around 2015.

● After the initial removal of the carbon prices (which contributes to the initial fall), carbon pricing (in some form) is assumed to contribute once again to rising prices post-2020.

○ The dip in prices in 2031 is due to the assumed end of the LRET, which reduced green costs.

The projections for electricity prices in Figure 1 refer to the Medium scenario for the energy market. Electricity prices under the Low and High demand scenarios for the energy market are presented and discussed in the body of this report.

Figure 1: Electricity: residential retail, all states, Real index, Medium
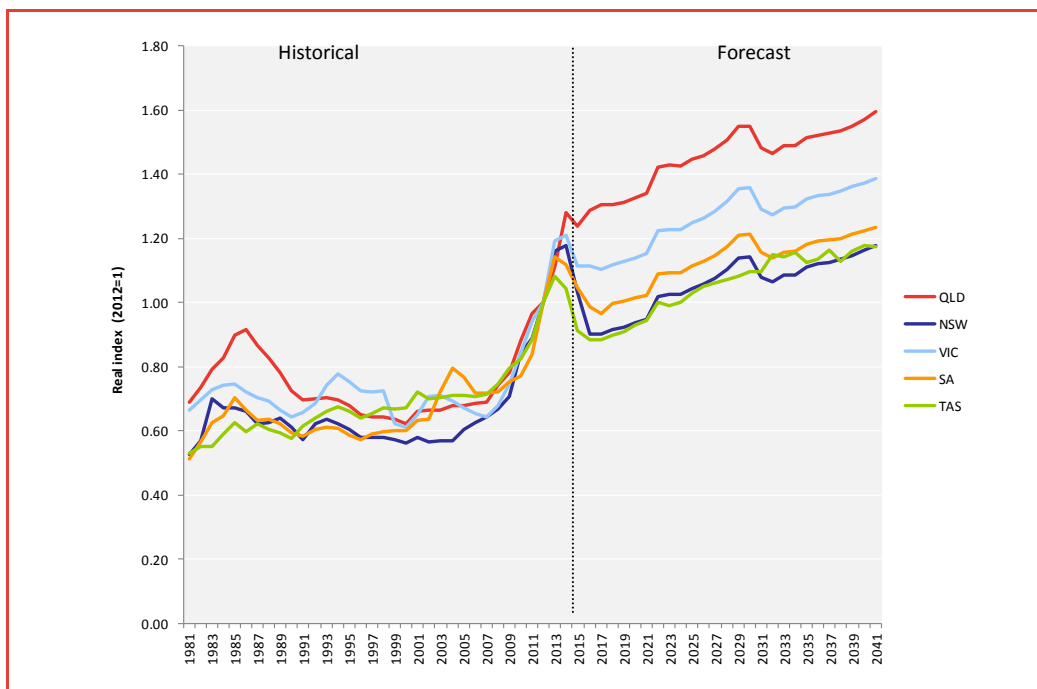
Source: Frontier Economics

1 Introduction

1.1 Outline

AEMO engaged Frontier Economics to provide long-term energy market forecasts to be used as inputs into AEMO's forecasts of electricity consumption for the 2015 National Electricity Forecast Report (NEFR). AEMO publishes these forecasts on its website, and updates them annually. The electricity price forecasts produced for this report reflects representative retail prices for residential and business customers. This includes wholesale, network and other costs. Where possible, network cost estimates reflect the latest regulatory determinations.

In this report, three sets of forecasts are presented. The medium or base case is intended to reflect the most likely case. Two alternative scenarios are presented as sensitivities to test the likely bounds of low and high **demand** as forecast by AEMO. As the focus of this report and modelling is to provide price inputs into AEMO's demand forecast, this means that our Low demand scenario has been developed to forecast high prices, and conversely.

In developing these high/low sensitivities there is a trade-off between likely outcomes and testing extreme bounds: wider bounds for various input assumptions will provide a greater sensitivity range but there is reduced likelihood of these extremes being reached.

In accordance with AEMO's timeline, this report reflects information available up to March 2015.

1.1.1 Modelling and forecast approach

Figure 2 provides an overview of the modelling approach to developing the retail price forecasts. A detailed summary of the modelling methodology is provided in Appendix A. The forecasts involve a combination of detailed wholesale/green market modelling using Frontier's proprietary market model (*WHIRLYGIG*) combined with details estimates of network and retail components. Where possible, network cost estimates reflect the most recent AER Determination for the next regulatory period. Where no AER determination is available, we rely on proposals submitted by Network Service Providers (NSPs).

The energy price modelling has been conducted independently of any economic modelling.

Figure 2 Overview of modelling approach
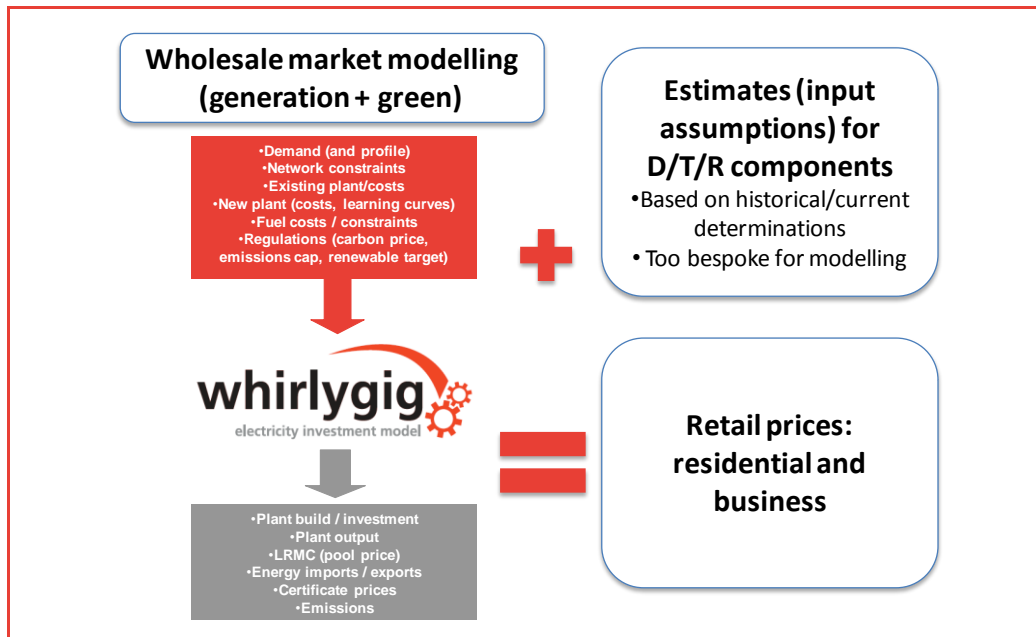
Source: Frontier Economics

1.2 Structure of the report

The report is set out as follows:

- the scenarios for the Australian economy are presented in section 2;

- the electricity price scenarios are reported in section 3;

- a detailed description of the modelling methodology is provided in Appendix A;

- a comparison of the forecasts contained in this report with those of other forecasters is contained in Appendix C

2 AEMO energy market scenarios

Frontier Economics has developed the energy market scenario assumptions in collaboration with AEMO. The key assumptions that vary for the energy market modelling are summarised in Table 1. These include:

O Network prices;

O Wholesale prices, as driven by coal prices, carbon prices, and demand; and

O Green costs, as driven by possible changes to the Large-scale renewable energy target (LRET).

Table 1:Summary of key assumptions by energy scenario

Driver		Scenario			
		LOW CENTRALISED ENERGY DEMAND (High prices)	MEDIUM CENTRALISED ENERGY DEMAND (Base case)	HIGH CENTRALISED ENERGY DEMAND (Low prices)	Comment
Network prices	NSW	Assume final determination similar to NSP proposals	AER draft determination (~30% reduction in FY2016)	Assume AER draft becomes final	Frontier Economics has not taken a position on the likely outcome of Final AER determinations, or the likelihood of NSP appeal. The NSW Medium/Base case reflects the Draft AER determination while other states reflect the NSP proposals as no AER draft determination had been released at the time of this modelling/report.
	QLD	Assume final determination similar to NSP proposals	NSP proposals	Assume AER determination is similar to Draft NSW (~30% reduction in **FYE2016**)	
	SA	Assume final determination similar to NSP proposals	NSP proposals	Assume AER determination is similar to Draft NSW (~30% reduction in **FYE2016**)	For the High/Low scenarios, we assume that in the short-term the NSP proposals will reflect an upper bound and the AER determination will reflect a low bound. Where no AER determination is available, we assume that possible findings may reflect similar reductions to the NSW determination. This is intended as a low sensitivity in this case, not an attempt to pre-empt any AER findings.
	VIC	Constant nominal	Constant nominal	Assume AER determination is similar to Draft NSW (~30% reduction in **FYE2017**)	
	TAS	Constant nominal	Constant nominal	Assume AER determination is similar to Draft NSW (~30% reduction in **FYE2018**)	
	Long-run (post 2018)	Rising ~1%p.a. real	Constant real	Falling ~1%p.a. real (rising nominal)	We have not assumed any specific factors contribute to changes in long run network costs but the range reflects a reasonable sensitivity. Rising/falling network costs could be due to changes in average load factor, capital costs, opex (labour productivity), for example.
Whole-sale	Coal costs (non mine-mouth)	High (+$0.5/GJ)	Frontier assumption	Low (-$0.5/GJ)	This reflects approximately $15/t variation in international coal prices. This is only relevant for potential coal export mines (NSW and Qld black coal).

Driver		LOW CENTRALISED ENERGY DEMAND (High prices)	MEDIUM CENTRALISED ENERGY DEMAND (Base case)	HIGH CENTRALISED ENERGY DEMAND (Low prices)	Comment
					Scenario
	Demand	**Electricity:** AEMO 2014 NEFR "Low" (Scenario 6)	**Electricity:** AEMO 2014 NEFR "Medium" (Scenario 3)	**Electricity:** AEMO 2014 NEFR "High" (Scenario 2)	These assumptions are to ensure consistency between the price output and demand input. However, these assumptions also reduce the extremity of the price sensitivities and risk "cross-over" between scenarios: High demand will tend to cause higher prices, and conversely.

The demand assumptions reflect the original 2014 NEFR, not the December updates. |
| | Carbon price (supply side) | **Short term:** $0 from 1st of July 2014 – end 2017-18 (4 years). **Long term:** Treasury 2011 Slow Growth Low Pollution estimates for 550ppm CO2 emissions. (Core), phased in over 4 years | **Short term:** $0 from 1 July 2014 – end 2020-21 (7 years). **Long term**: European (EUA) prices. | **Short term:** $0 from 1 July 2014 – end 2020-21 (7 years). **Long term:** Clean Development Mechanism (CDM) prices (CERs) | This will only affect longer term prices. |
| Green | LRET | Unchanged target(41TWh) | Unchanged target (41TWh) | LRET reduced (to 27TWh) | A reduced RET will lower the direct RET cost lower, but the indirect cost is potentially higher due to merit order effect. A reduced RET may lead to unchanged or potentially higher retail price. We assume that the LRET will end in 2030, as currently legislated. |

Source: Frontier Economics

AEMO energy market scenarios   Final

2.1   Network costs

Table 2 sets out the AER's regulatory timetable and information currently available to inform network cost estimates. In general, this report adopts the AER (draft) determination where available or, where none is available, the NSP draft proposal (Qld, SA). For Vic/Tas there is no NSP draft proposal available for distribution costs, hence we assume constant nominal costs in the short run, consistent with the AEMC 2014 Retail price trends.

For distribution costs, at the time of this report AER draft determinations are only available for NSW[1]. These costs reflect a considerable reduction on the NSP proposals (almost 30%), reflecting a combination of lower WACC and lower OPEX in the AER draft determination compared with NSP proposals. The revised NSP proposals (Jan 2015) do not reflect similar reduction s. This report does not take a position on the likely outcome of the regulatory process other than most recent information available. Hence, the Medium (Base case) NSW network costs reflect a material reduction in network costs (in line with the AER) while other regions reflect NSP proposals or constant costs, which do not include the reductions in network costs that the NSW draft determination reflects.

For the high demand (low price) scenario we consider a sensitivity where subsequent AER determinations in other states reflect similar reductions on NSP proposals (around 30% for distribution); this means that the NSW network cost in this scenario is the same as the Medium case in the short run. In the long run our sensitivities reflect a 1% real increase or decrease per annum, which could be attributed to changes in network load factor, or variance in capex or opex that are higher or lower than constant real costs.

---

[1]   See Ausgrid: https://www.aer.gov.au/node/11483, Endeavour Energy: https://www.aer.gov.au/node/11484, Essential Energy https://www.aer.gov.au/node/11485

Table 2: Regulatory timetable

State/ Territory	Service provider	Regulatory control period		Regulatory process				Assumption basis
		Date	Length	Regulatory proposal	Draft AER decision	Revised reg proposal *	Final decision	
Electricity transmission								
Vic	AusNet Services	1 Apr 2014 - 31 Mar 2017	3 yrs	28 Feb 2013	30 Aug 2013	11 Oct 2013	31 Jan 2014	
		1 Apr 2017 - 30 Mar 2022	5 yrs	31 Oct 2015	30 Jun 2016	Sep 2016	31 Jan 2017	No NSP proposal or AER decision yet
NSW/Tas	TransGrid, TasNetworks	1 Jul 2015 - 30 Jun 2019	3, 4 yrs	31 May 2014	27 Nov 2014	13 Jan 2015	30 Apr 2015	Draft AER (revised NSP proposals also available)
Qld/NSW	Directlink	1 Jul 2015 - 30 Jun 2025	10 yrs	31 May 2014	27 Nov 2014	13 Jan 2015	30 Apr 2015	
Qld	Powerlink	1 Jul 2017 - 30 Jun 2022	5 yrs	31 Jan 2016	30 Sep 2016	Dec 2016	30 Apr 2017	No NSP proposal or AER decision yet
SA	Electranet	1 Jul 2018 - 30 Jun 2023	5 yrs	31 Jan 2017	30 Sep 2017	Dec 2017	30 Apr 2018	
VIC/SA	Murraylink	1 Jul 2018 - 30 Jun 2023	5 yrs	31 Jan 2017	30 Sep 2017	Dec 2017	30 Apr 2018	
Electricity distribution								
NSW/ACT	Ausgrid, Endeavour Energy, Essential Energy, ActewAGL	1 Jul 2014 - 30 Jun 2015	1 yr	31 Jan 2014	n.a.	n.a.	16 Apr 2014	
		1 Jul 2015 - 30 Jun 2019	4 yrs	31 May 2014	27 Nov 2014	20 Jan 2015	30 Apr 2015	Draft AER (revised NSP proposals also available)
Qld/SA	Energex, Ergon Energy, SA Power	1 Jul 2015 - 30 Jun 2020	5 yrs	31 Oct 2014	30 Apr 2015	Jul 2015	31 Oct 2015	Revised NSP proposals available. No AER decision.
Vic	CitiPower, Powercor, Jemena, Jemena, AusNet Services, United Energy	1 Jan 2016 - 30 Dec 2020	5 yrs	30 Apr 2015	31 Oct 2015	Jan 2016	30 Apr 2016	No NSP proposal or AER decision yet
Tas	TasNetworks	1 Jul 2017 - 30 Jun 2022	5 yrs	31 Jan 2016	30 Sep 2016	Dec 2016	30 Apr 2017	

Source: AER. Orange cells reflect information available now. Green cells reflect no information available yet.

2.2 Demand

Figure 3 to Figure 7 show assumed electricity demand by state and by scenario. In each state, the high, medium (base) and low reflects the corresponding scenario in the 2014 NEFR:

○ "High demand" reflects the 2014 NEFR Scenario 2,

○ "Base demand" reflects the 2014 NEFR Scenario 3 (planning); and

○ "Low demand" reflects the 2014 NEFR Scenario 6.

These estimates reflect the original 2014 NEFR, not the December 2014 updates released by AEMO. However, the purpose of the demand input assumption is to reflect a starting point for the price forecasts that will be consistent with the likely output demand forecasts from the 2015 NEFR. The 2014 NEFR scenarios should reflect this.

Figure 3 Assumed electricity demand: QLD
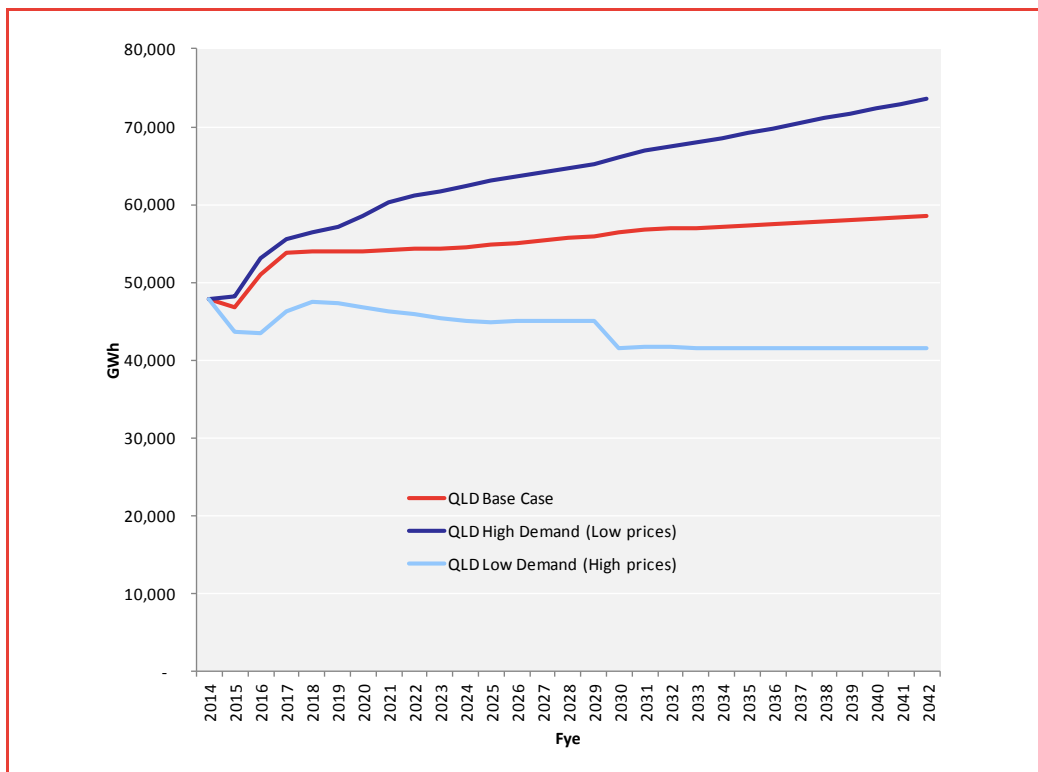
Source: Frontier Economics / AEMO

Figure 4 Assumed electricity demand: NSW
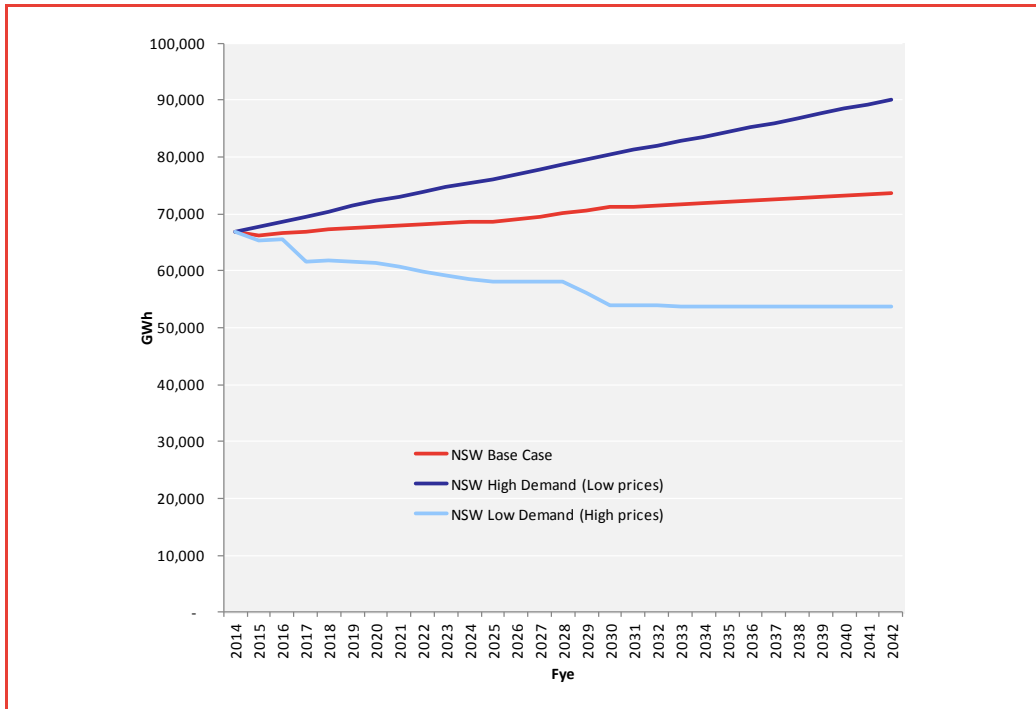
Source: Frontier Economics / AEMO

Figure 5 Assumed electricity demand: SA
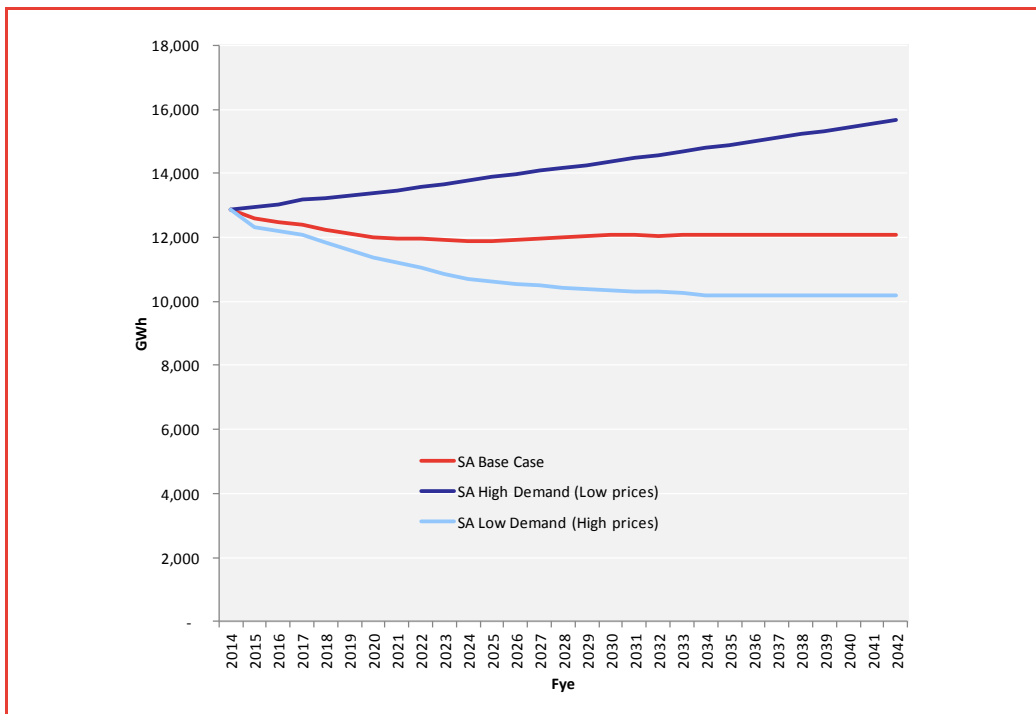
Source: Frontier Economics / AEMO

Figure 6 Assumed electricity demand: VIC

Source: Frontier Economics / AEMO

Figure 7 Assumed electricity demand: TAS

Source: Frontier Economics / AEMO

2.3   Carbon price

Figure 8 summarises the assumed carbon price by scenario. All scenarios assume that the carbon price is replaced by Direct Action from July 2014 (starting in FYe2015). It is assumed that the practical impact of Direct Action on the electricity sector will be no net impact on electricity prices. This is based on the stated principles of Direct Action that funding of abatement be sourced from the Emissions Reduction Fund (ERF) as opposed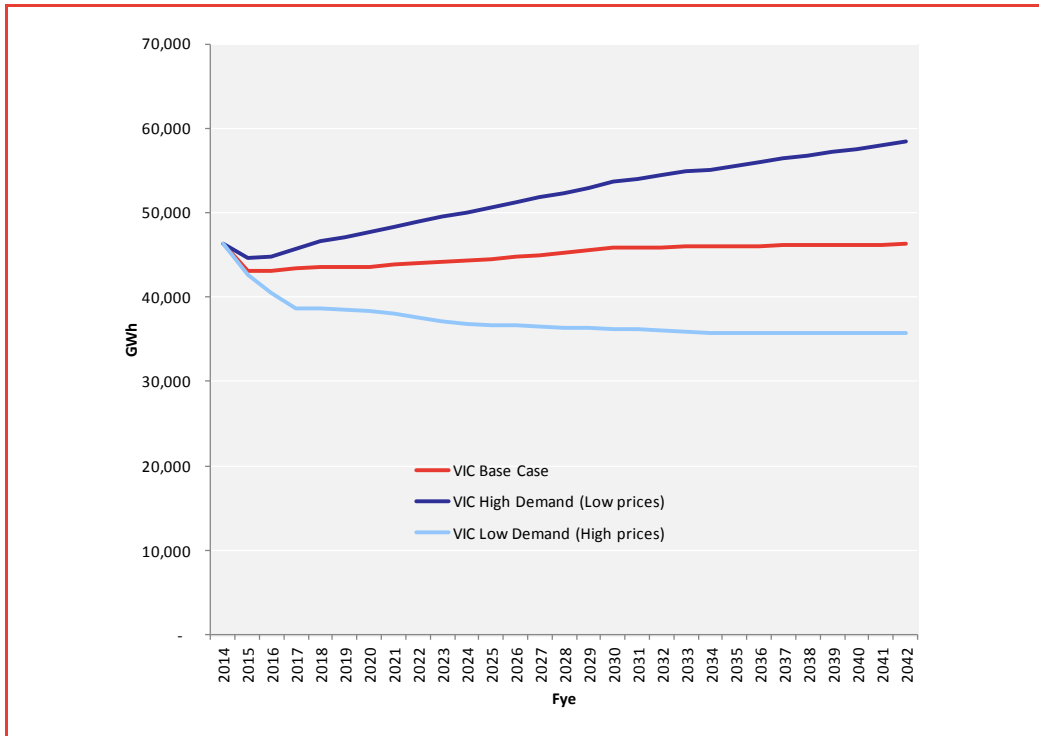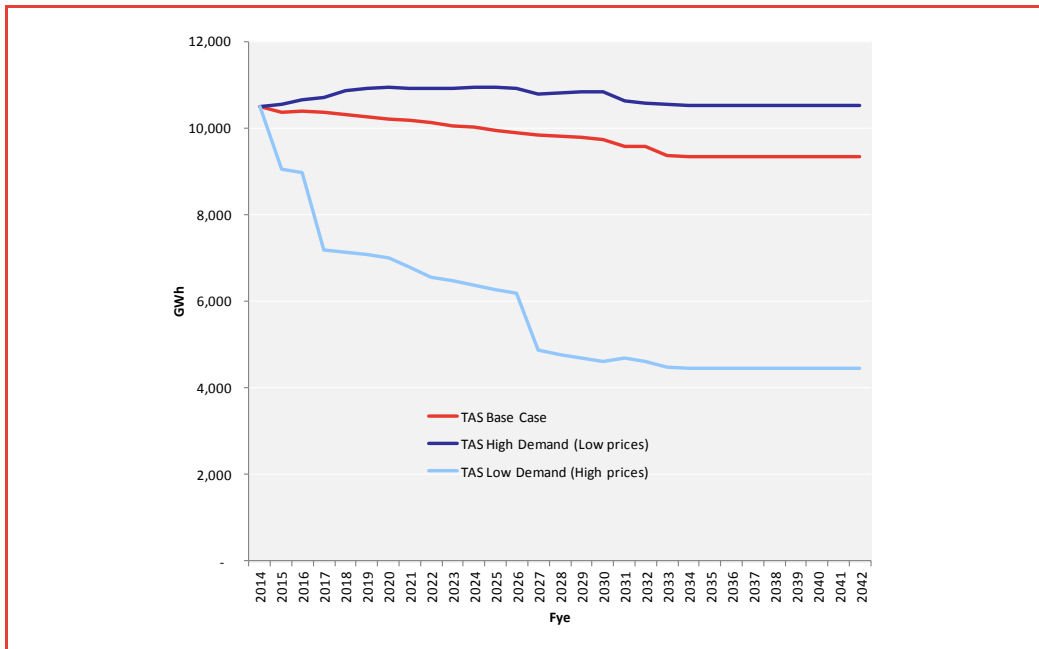 to consumers, and that price effects on electricity will be reduced.[2] After 2020 it is assumed that some form of carbon cost is reintroduced, in line with AEMO's scenario assumptions.

Figure 8 Assumed carbon price by scenario

*Pre 2020 - All scenarios assume carbon price is removed at the end of FYe2014, and the impact of Direct Action is zero net effect on prices. Post 2020 - **Medium**: Based on EUA forward prices (EU ETS) from the EEX **High:** Based on CER forward prices (CDM) from the EEX (http://www.eex.com/en/Market%20Data/Trading%20Data/Emission%20Rights/European%20Carbon%20Futures%20%7C%20Derivatives) **Low:** Based on Commonwealth Treasury forecasts from Strong Growth, Low Pollution (Core 550ppm case).*

Source: Frontier Economics

---

² This is not necessarily the same as no impact on electricity sector emissions (or generators) but the purpose of this modelling is to understand the impact on prices.

2.4 Scenarios and results (impact on prices)

In developing the assumptions for the "Low" demand and "High" demand scenarios, the changes in variables include both:

- **supply-side factors** (that result in higher and lower generation costs, such as the carbon price, fuel prices); and
- **demand-side factors** (higher and lower demand, for example, due to GDP growth).

The focus of the scenarios was to test differences in the quantity of electricity consumed to ensure that a key output from this project (retail electricity prices) are consistent with AEMO's Low, Medium and High demand forecasts, as this feeds into AEMO's econometric model of demand.

Developing the scenarios is complicated because demand and prices are interrelated (demand affects price, and conversely): demand is an input into our modelling and prices are an output, while price is an input into the AEMO NEFR and demand is the output.

For the **high** demand scenario we have adjusted input assumptions affecting the cost of electricity supply with the intent to forecast **low** electricity price forecasts: these lower prices are intended to drive higher demand in the corresponding NEFR scenario (demand modelling). However, high demand is also an input into this scenario for the price modelling, and this results in higher price forecasts than would otherwise be the case. If the demand effect is stronger than the assumed change in supply costs then prices can cross-over, resulting in higher prices in the high demand scenario.

Figure 9 provides a stylised example to illustrate this. In both cases, the supply-curve is upward sloped, similar to a generation merit order where the cheapest generation is dispatched first and more expensive generation only dispatched at times of high demand (eg summer). Demand in this example is downward-sloped: if prices are higher, then in the long run less will be consumed (though the example is equally applicable if demand is vertical, which means completely unresponsive to price changes). The price and quantity is set by the intersection of supply and demand.

The left-hand example illustrates the impact of a shift in demand with supply unchanged. In this case, demand shifts left to illustrate a fall in demand due to lower GDP, for example. For a given supply curve (costs unchanged) this would result in lower prices in the "low" scenario. **In this case, the change in demand causes the change in prices.** (The quantity consumed would have fallen further if not for the fall in price).

The right-hand example illustrates the impact of a shift in supply (generation costs) with demand unchanged. In this case, assumptions that increase generation

costs will shift the supply-curve left: this will result in lower quantity, but this results in higher prices. These higher prices are driven by the supply side: **in this case, the change in prices causes the change in demand.**

The net effect is that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. The design of our scenarios for the 2015 modelling and report has intended to emphasise the supply-side effects to overcome any demand-side effects, so that high energy prices feed into the Low demand scenario, and conversely.

Figure 9 Electricity prices: stylised demand-side versus supply-side factors
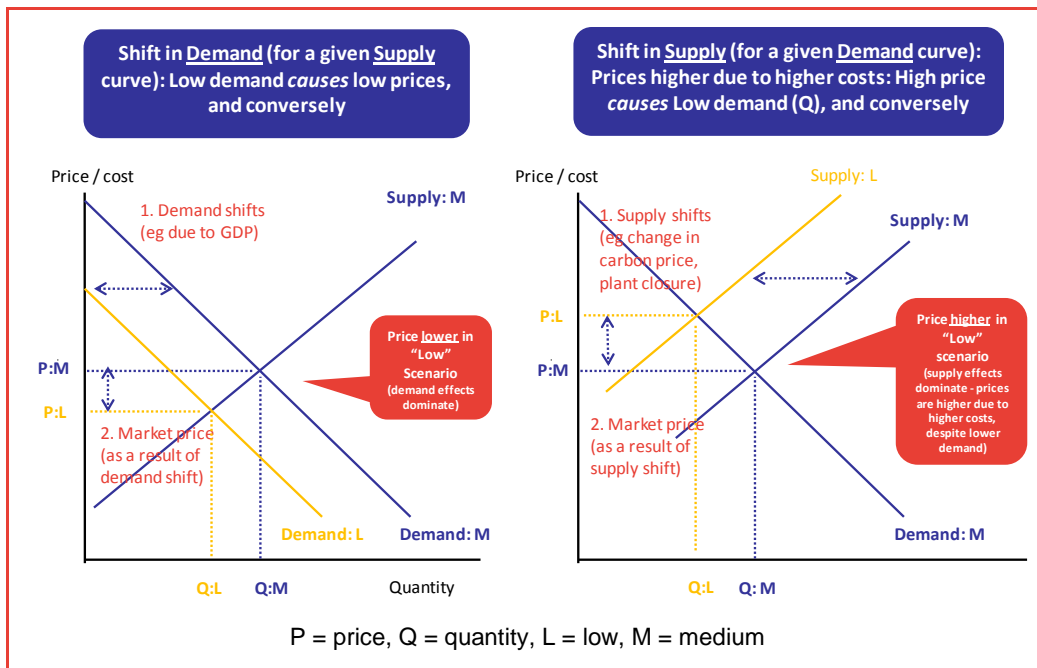
Source: Frontier Economics

3 Retail electricity forecasts to 2039/40

This section presents forecasts for retail electricity prices in each NEM state until 2039/40. The modelling methodology is described in Appendix A. Results are discussed in general in section 3.1 (overview). The subsections that follow provide more detailed state results, including:

- a summary of results by state, including comparisons with historical price estimates,

- a discussion of the components of results, divided by wholesale costs, transmission, distribution, green (LRET, SRES and other state based schemes). This includes estimates of the contribution of each component to projected price changes until 2020; and

- comparisons with alternate sources and projections for each state, including NIEIR's prior projections for AEMO (2012, 2013) and AEMC estimates of residential retail price trends from 2012, 2013 and 2014 (which review and summarise each state regulatory determination and policy).

In most cases, the key methodologies and drivers of results/differences between scenarios largely the same for each state. However, to enable readers to review each state sub-section as standalone, the explanations are provided (and repeated where applicable) in full.

3.1 Overview

This sub-section discusses general methodology and results, including:

- the gathering of **historical** price estimates; and

- a summary of residential results by region (medium case).

3.2 Historical prices

Estimates of historical prices are required as these are used in an econometric model of demand. There is no consistent dataset that reflects absolute prices in c/kWh (as opposed to an index) that covers the entire period 1980-2014. Various sources available include:

- **ABS CPI for electricity[3]**: This is available for the entire time period, but only in index terms.

- **ESAA Electricity prices in Australia (various years):** this is available in c/kWh, but only until 2003 at the latest.

---

[3]   *ABS 2013 Sep CPI release document 640108, Table 11.*

    ○ **AEMC 2012, 2013[4] and 2014**: the AEMC estimated Standing Offer and Market prices for residential retail in 2012 and in 2013, largely based on regulated determinations by state. These reflect c/kWh but do not include prior years.

These three data sources can be combined to develop a price path for the entire period (1980-2014). For example, ESAA data from 2003 (or from 1980) can be rolled forward at CPI to 2014, or AEMC data can be rolled back at CPI to 1980. If the ESAA and ABS CPI data are consistent between 1980-2003 then results rolled forward from 1980 (at CPI) should be the same as results rolled forward from 2003. Similarly, we can compare the ESAA data from 2003 rolled forward at CPI against the AEMC data from 2014 rolled back at CPI. In some cases there are minor differences (CPI implies higher prices than ESAA, or vice versa).

Across all states, the 2014 AEMC prices (rolled back at ABS CPI for electricity in that State) appear consistent with historical ESAA data. The comparisons of results by source are provided in each State sub-section.

3.3   Summary results (residential, medium case)

Figure 10 presents the estimated historical residential prices against our projections for each state for the Medium scenario, as a real index. The following key results are evident:

○ Historically, residential prices had been relatively flat in real terms until around 2007;

○ Prices increased rapidly from 2007-2014, largely due to rising network costs;

○ A further increase is evident in FYe2013, when the carbon price was introduced. However prices also fell from FYe2014 to FYe2015 with the removal of the carbon price.

○ Projected wholesale prices are relatively flat for several years before rising in the longer term. This is due to the following reasons:

    ● Currently, wholesale prices are very low. This is due to weak demand and a ramping up of renewable investment to meet the renewable energy target (LRET), which contributes to oversupply;

---

[4]   AEMC 2013 refers to 2013 Residential Price Trends, Dec 2013 http://www.aemc.gov.au/Media/docs/2013-Residential-Electricity-Price-Trends-Final-Report-723596d1-fe66-43da-aeb6-1ee16770391e-0.PDF AEMC 2012 refers to Possible future retail electricity price movements: 1 July 2012 to 30 June 2015, Mar 2013, http://www.aemc.gov.au/Media/docs/ELECTRICITY-PRICE-TRENDS-FINAL-REPORT-609e9250-31cb-4a22-8a79-60da9348d809-0.PDF *AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx*

- As demand eventually recovers, the demand/supply balance is expected to tighten. This does not require rising demand in all states/markets: demand is generally expected to rise in Qld, NSW and Vic (larger markets) and due to interconnection of regions, this is likely to affect demand/prices in other NEM regions (the regions with faster growing demand will tend to export less from, or import more to, other regions);

- Gas prices are projected to rise over time, contributing to higher generation costs. This is largely driven by the introduction of export LNG markets in the eastern states in Qld from around 2015. This rising gas cost particularly drives results around 2030 as the demand/supply balance tightens in the NEM;

- After the initial removal of the carbon prices (which contributes to the initial fall), this is assumed to contribute once again to rising prices post-2020;

○ In NSW, network costs fall sharply in 2016 in line with the recent AER Draft Determinations. Draft determinations are not yet available for other regions (for the next regulatory period) and the NSP proposals that are available do not include similar reductions in network costs.

○ We assume that the LRET ends in 2030, and this causes a dip in most regions in 2031 (due to lower green costs). This dip also occurs in Tas, though it is less evident due to a small rise in wholesale costs in that year.

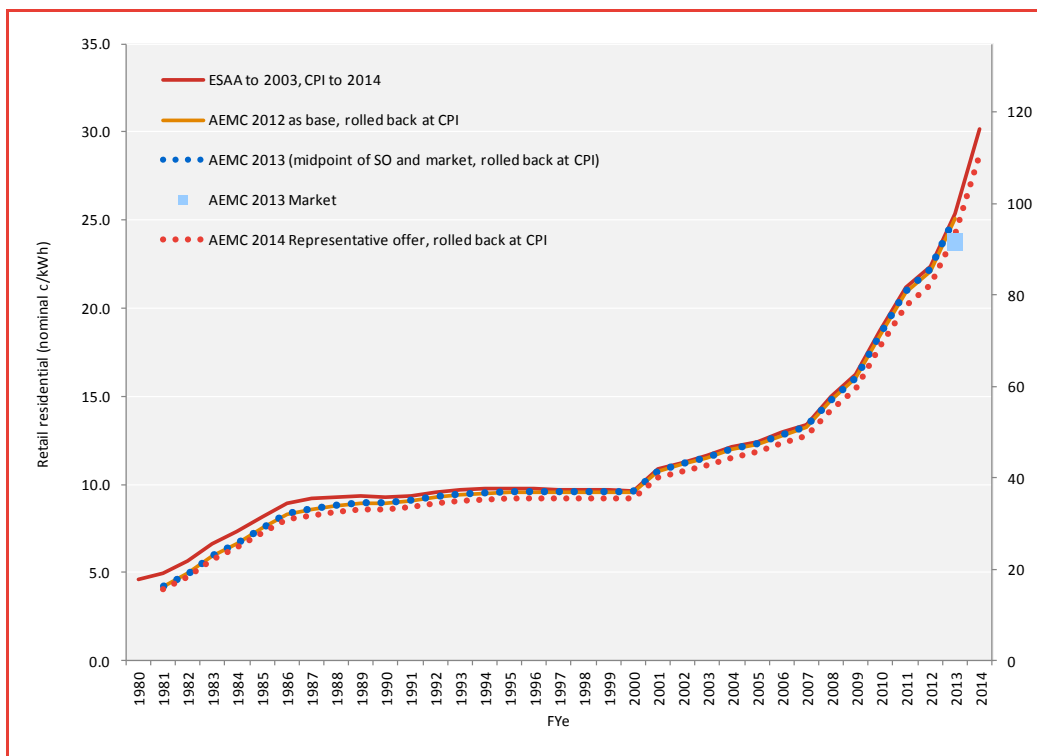Figure 10: Electricity: residential retail, all states, Real index, Medium case
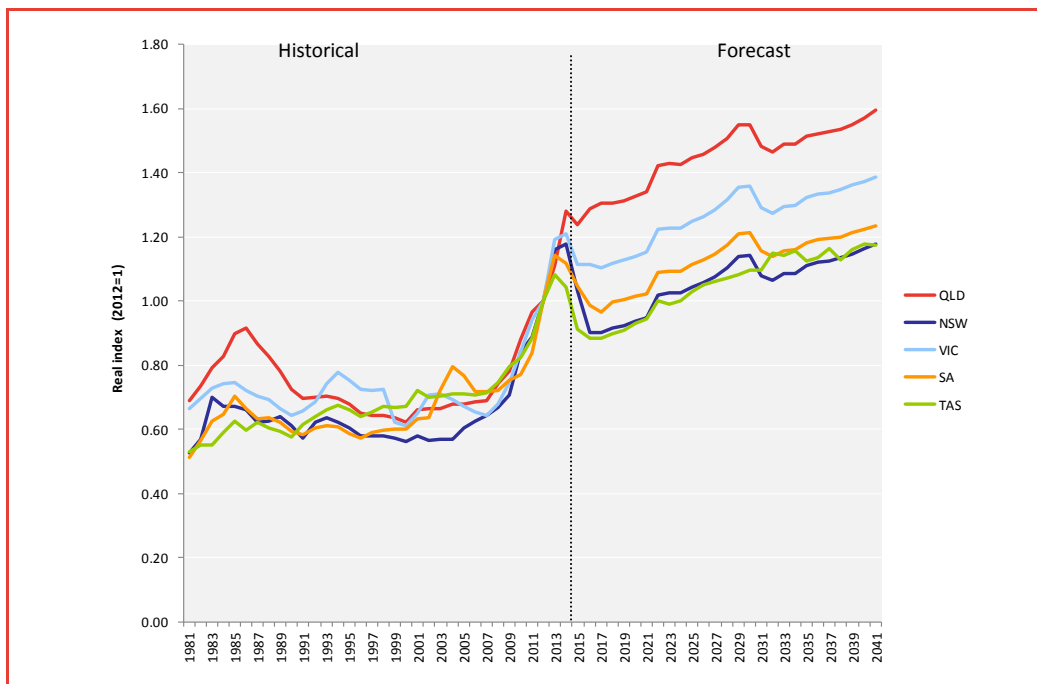
Source: Frontier Economics

3.4   Queensland

3.4.1   Historical: residential

Figure 11 shows an estimate of the historical retail residential electricity price in Qld, applying different methodologies and sources. In Qld, prices were relatively steady (in nominal terms) until around 2000, but have escalated rapidly since then, particularly over the past 6-7 years as network costs have risen.

Figure 11 Electricity: Historical residential retail, Qld, nominal c/kWh

Source: CPI refers to state electricity CPI from ABS 2014 Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). AEMC 2013 refers to 2013 Residential Price Trends, Dec 2013 http://www.aemc.gov.au/Media/docs/2013-Residential-Electricity-Price-Trends-Final-Report-723596d1-fe66-43da-aeb6-1ee16770391e-0.PDF
*AEMC 2012 refers to Possible future retail electricity price movements: 1 July 2012 to 30 June 2015, Mar 2013, http://www.aemc.gov.au/Media/docs/ELECTRICITY-PRICE-TRENDS-FINAL-REPORT-609e9250-31cb-4a22-8a79-60da9348d809-0.PDF.*
AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx

3.4.2 Historical: Business

Figure 12 compares this estimate of business electricity prices against residential. These were relatively similar (in nominal terms) from 1995-2000 but have diverged significantly since 2000 as residential prices have risen more rapidly.

Figure 12 Electricity: Historical business and residential retail, Qld, nominal c/kWh
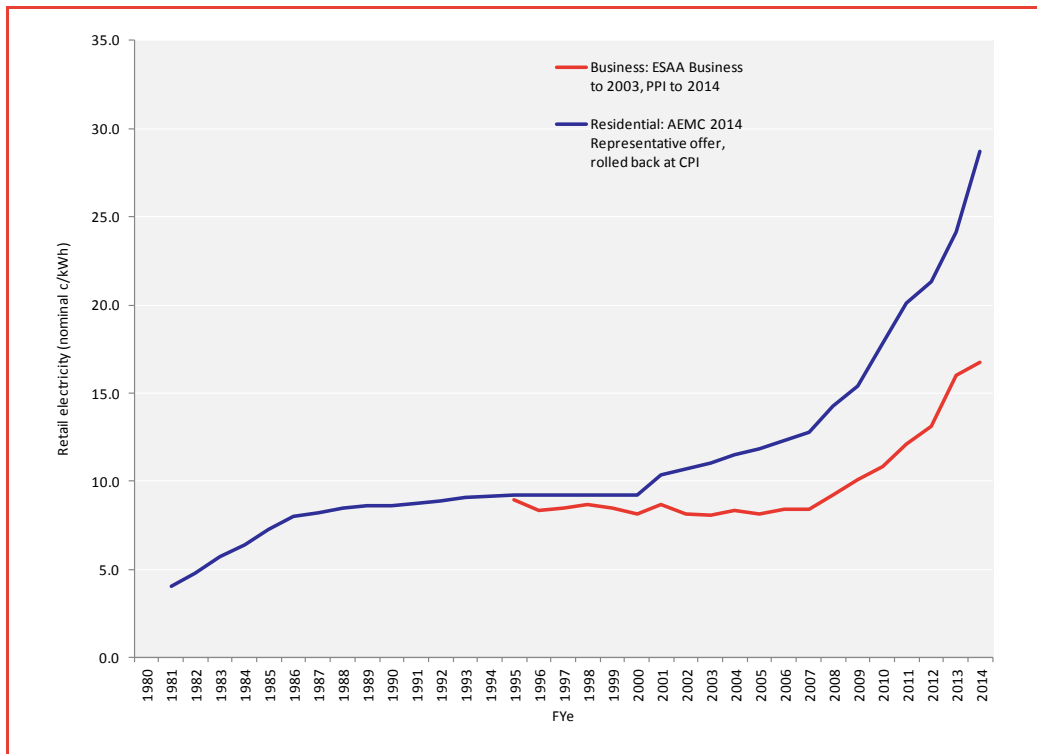
Source: CPI refers to state electricity CPI from ABS 2014Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). PPI refers to ABS 6427.0 Producer Price Indexes, Australia, Table 13. (electricity). AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx

3.4.3 Results: comparisons of scenarios

Figure 13 presents the historical residential prices against our projections for each scenario as a real index. The following key results are evident:

○ Historically, residential prices had been flat (or falling) in real terms until around 2007;

○ Prices increased rapidly from 2007-2014, largely due to rising network costs;

○ A further increase is evident in FYe2013 when the carbon price was introduced though prices fell from FYe2014 to FYe2015 due to the removal of the carbon price.

○ In the Medium and Low scenarios, projected retail prices begin to rise in real terms from 2016 as increases in network costs offset the initial fall in wholesale costs once carbon is removed.

○ Currently, wholesale prices are very low. This is due to weak demand growth and a ramping up of renewable investment to meet the renewable energy target (LRET);

- As demand eventually recovers the demand/supply balance can be expected to tighten;

- Gas prices are projected to rise over time, contributing to higher generation costs. This is largely driven by the introduction of export LNG markets in the eastern states in Qld from around 2015;

- After the removal of the carbon prices (which contributed to a fall in wholesale cost from FYe2014-2015), this is expected to contribute once again to rising prices post-2020.

○ Comparing the different scenarios:

- Section 2.4 explains that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. Low demand will <u>cause</u> lower prices, but higher supply costs in the Low scenario will cause higher prices (which in turn should cause lower demand).

- **In the scenarios modelled, supply-side effects are expected to dominate in the short and long-run**. The "Low" demand scenario includes higher cost estimates, and this flows through to higher retail prices then the other scenarios, *despite* the lower demand in that scenario. Similarly, the "High" demand scenario has lower cost assumptions and these supply-side factors drive lower projected prices in the long-run, despite the higher-demand assumption.

- The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium/Base case, however this is more than offset by differences in network cost assumptions between the scenarios. In the High demand case, network costs are assumed to fall by a similar amount to the AER Draft Determinations for NSW, hence *retail* price forecasts in the High Demand case are consistently lower than the Medium Demand case.

Figure 13 Electricity: residential retail by case, Qld (Real index)
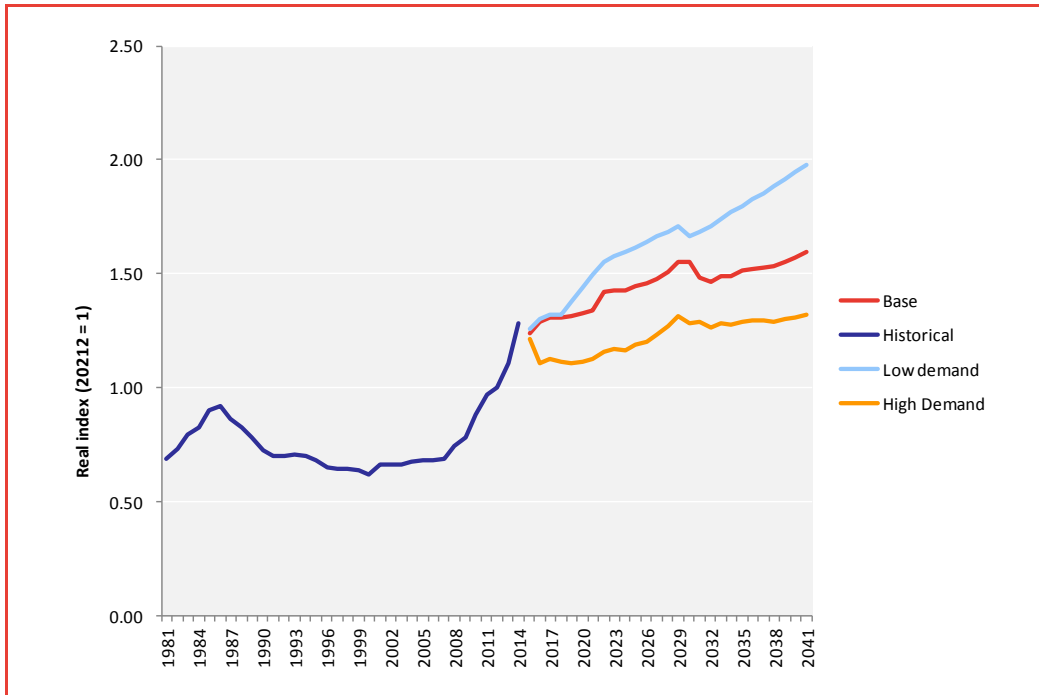
Source: Frontier Economics

Figure 14 Electricity: business retail by case, Qld (Real index)
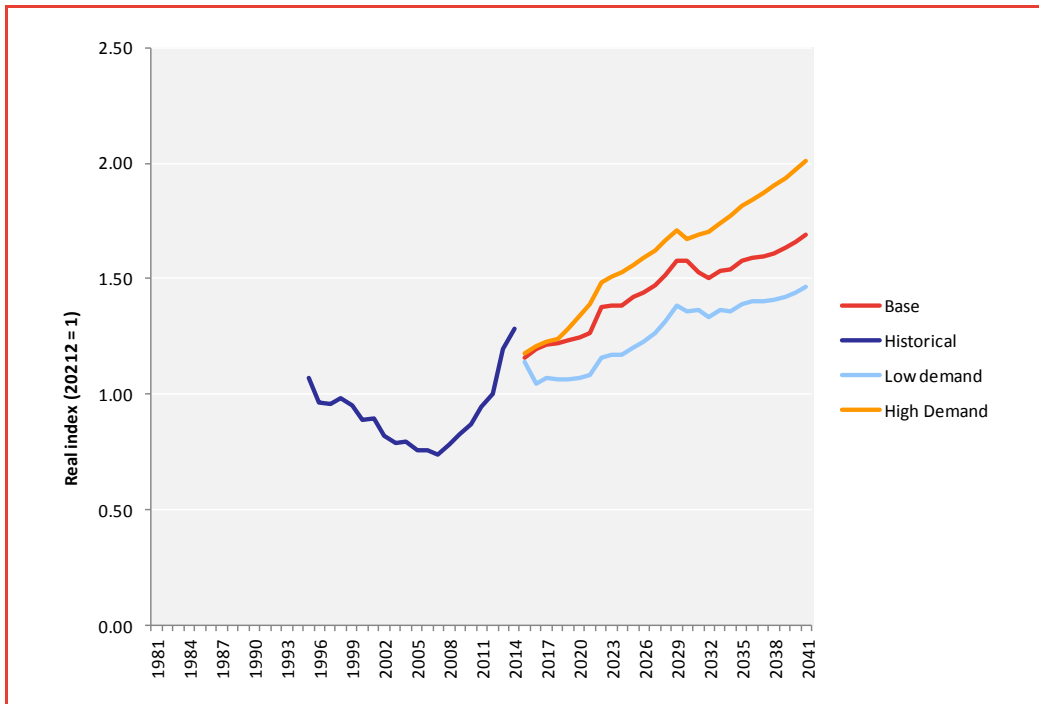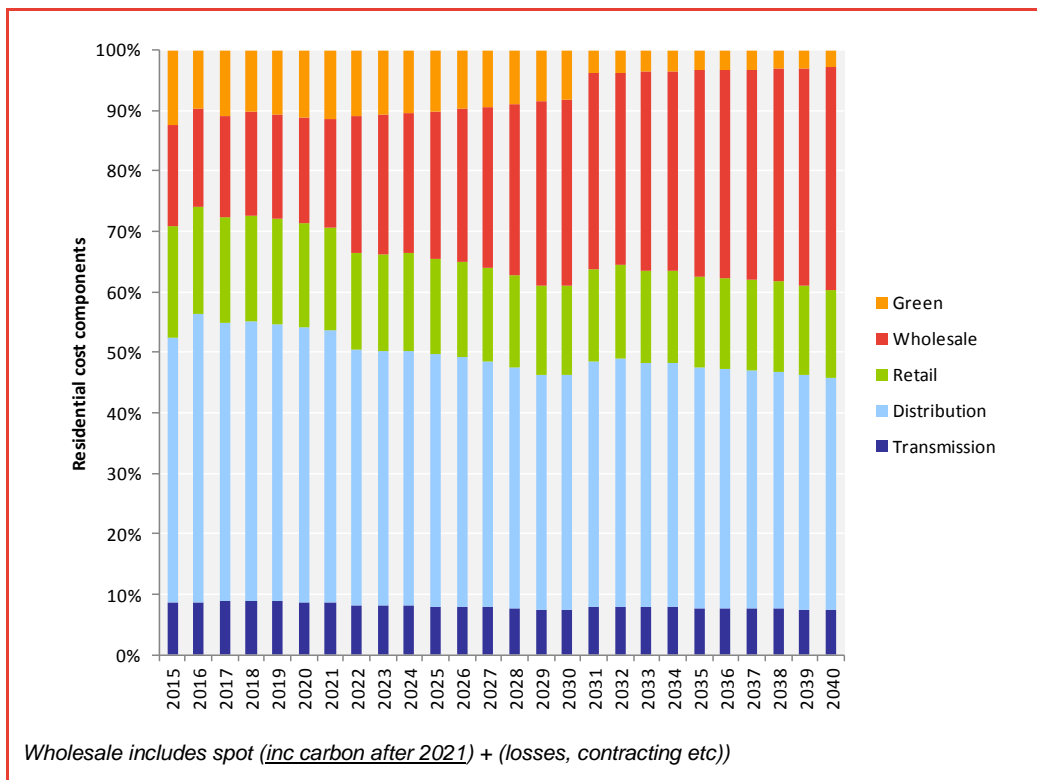

Source: Frontier Economics

3.4.4 Residential results by component

Figure 15 shows the contribution of each component to the final results in the Medium scenario. Distribution costs are expected to grow initially (reflecting current NSP proposals) but transmission and distribution costs are assumed to stabilise in real terms after the current regulatory period.

Wholesale costs are expected to rise in the long-run as the demand-supply balance eventually recovers, and due to rising gas and carbon prices. Beyond 2020, wholesale price changes mostly explain the change in retail prices. Green prices also contribute due to the rising LRET target (and prices), though we assume that the LRET ends in 2030 hence green prices fall from FYe2031.

Figure 15 Electricity: residential retail by component, Qld, Medium

Wholesale includes spot (inc carbon after 2021) + (losses, contracting etc))

Source: Frontier Economics

Table 3 provides a summary of the total change in residential retail prices (relative to 2014) and an approximate contribution of each component to that period's change. Between FYe2015-2020, the total projected change is an increase in real terms of 7.1%. This is due to an increase in distribution costs in line with NSP proposals. In the longer run to 2030, wholesale costs continue to rise, contributing a sustained rise in total retail costs of around 25.2% relative to 2015.

Table 3 Price change and contribution by component, Qld, real $ (Medium)

FYe	Source of change by component (contribution to total)					Total	Comment
	Trans	Dist.	Green	Retail	Whole-sale		
2014-2020	0.8%	4.7%	-0.4%	0.1%	1.9%	7.1%	Real prices are forecast to increase from 2015-2020, mostly due to rising network costs (particularly from 2015 to 2016 based on NSP proposals). Wholesale costs are projected to remain relatively flat in the short term (after the removal of the carbon price) due to slow demand growth and the ramping up of the RET (which leads to excess supply and mitigates price increases). Green costs are expected to remain relatively flat in Qld: despite the ramping up of the RET, costs from the solar bonus scheme are expected to fall.
2014-2030	0.8%	4.7%	-2.0%	0.1%	21.6%	25.2%	Real prices are forecast to increase by around 25% from 2015-2030. The contribution of network costs to this increase mostly occurs in the short term. In the longer term, the biggest contributing factor is projected to be increases in wholesale costs, mostly after 2020. This is due to tightening supply-demand balance as demand recovers and the RET flattens out. Other factors contributing to the wholesale cost increases are rising fuel costs (gas and coal) and the assumed reintroduction of some form of carbon cost. Green costs stabilise from 2020-2030 as the RET flattens out, and these costs reduce after 2030 as the RET is assumed to end in that year.

*Source: Frontier Economics. Note: the source of change by component reflects the percentage contribution to the change in **total** price (such that the sum of each component adds to the total change. Carbon costs are reflected in wholesale costs.*
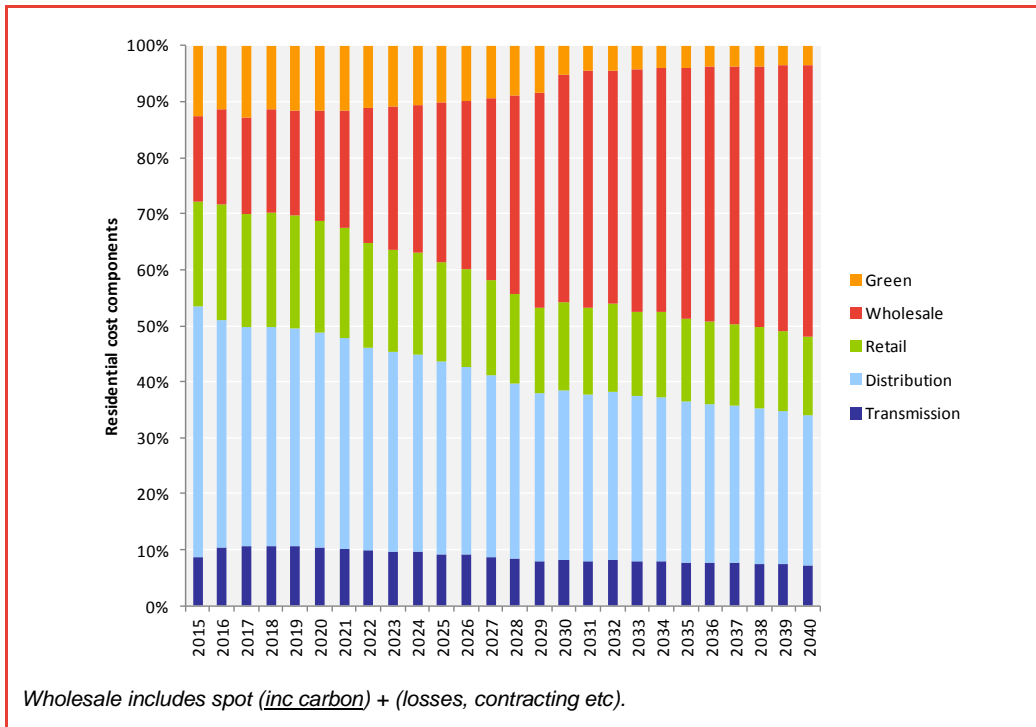
Figure 16 and Figure 17 show the price forecasts for the Low (and High) demand scenarios by component. Rising (falling) network costs are a key driver in these sensitivities. In particular, in the High demand scenario the network costs are assumed to fall from 2015/16 by a similar amount to the AER determination in NSW.

Figure 16 Electricity: residential retail by component, Qld, Low demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).
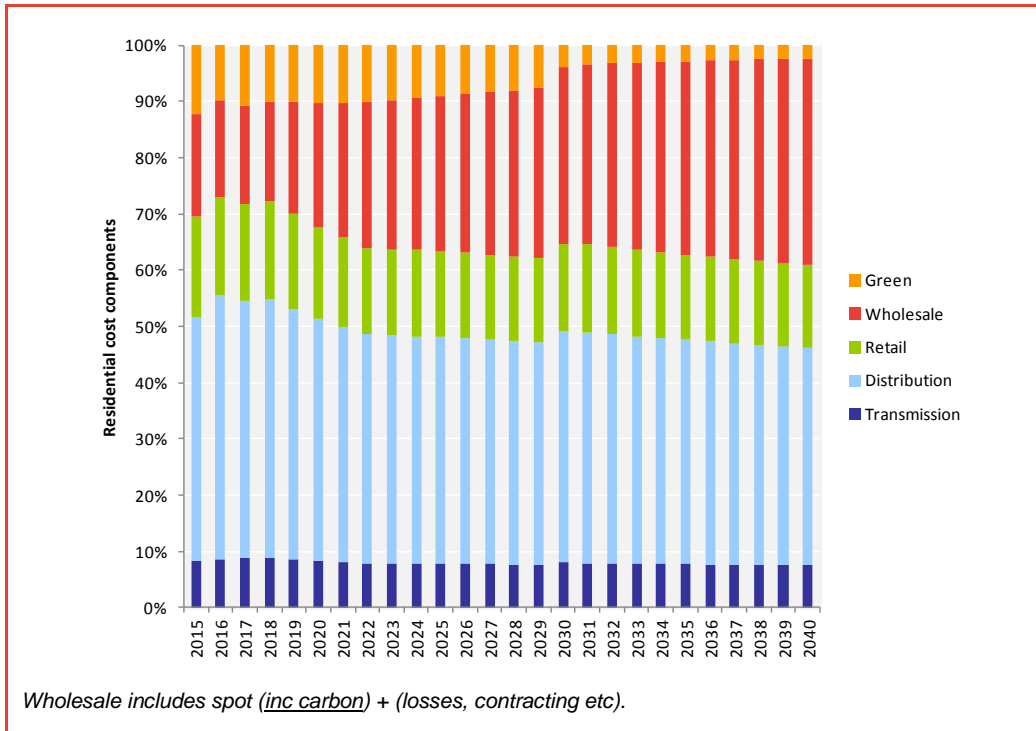
Source: Frontier Economics

Figure 17 Electricity: residential retail by component, Qld, High demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).

Source: Frontier Economics

Retail electricity forecasts to 2039/40   Final

3.4.5 Comparisons: alternate sources

Figure 18 presents a comparison of current and previous energy price projections used as inputs into AEMO's demand forecasts, as real indices rebased to 2012=100. The 2015 Frontier projections reflect more recent information regarding NSP proposals for network costs (a small increase), and changes to the solar bonus scheme. This results in higher interim forecasts than in 2014 (from 2017-2030). In the longer-run (post 2030) the higher network costs in the 2015 forecasts are offset by an updated assumption regarding the end of the LRET scheme in 2030 which results in a dip in the index in 2031 in the latest forecast (converging on the 2014 forecast). The current LRET legislation has the target ending in 2030 and we have assumed that this will not be extended, hence LRET costs are expected to fall to zero from 2031 in line with the end of the scheme. For the 2014 forecasts we implicitly assumed that the target would be extended to enable renewable projects built from 2020 onwards to earn more than ten years of LGC revenue (to better reflect project life spans).

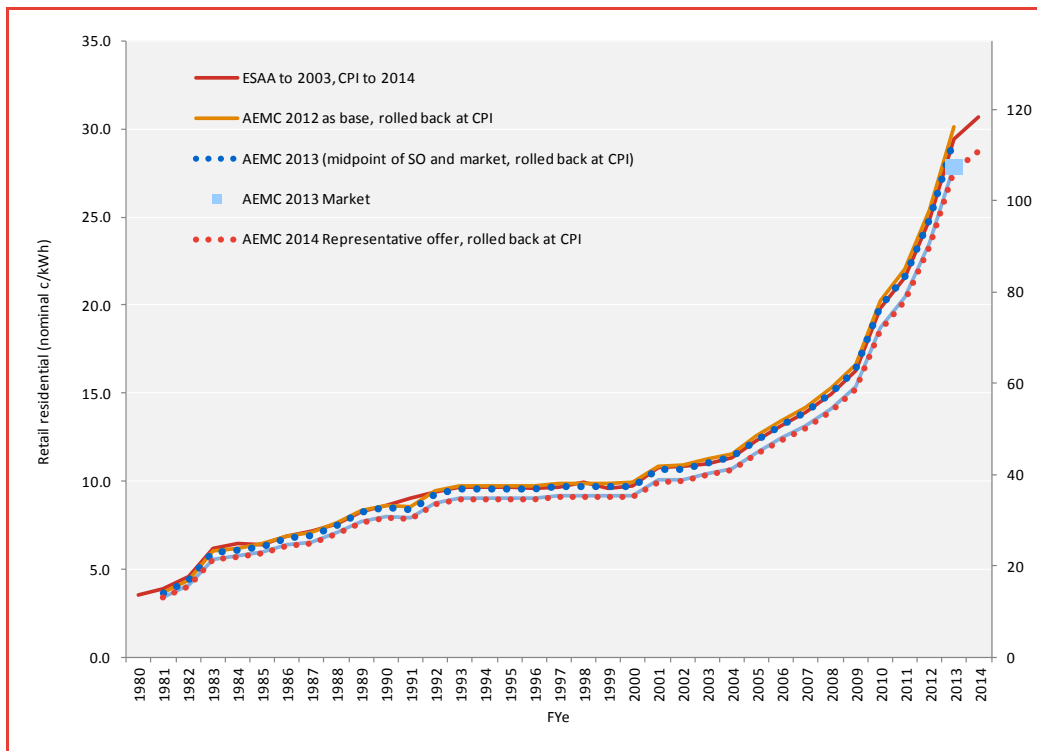Figure 18 Electricity: residential retail, Qld, real index, compared with previous projections
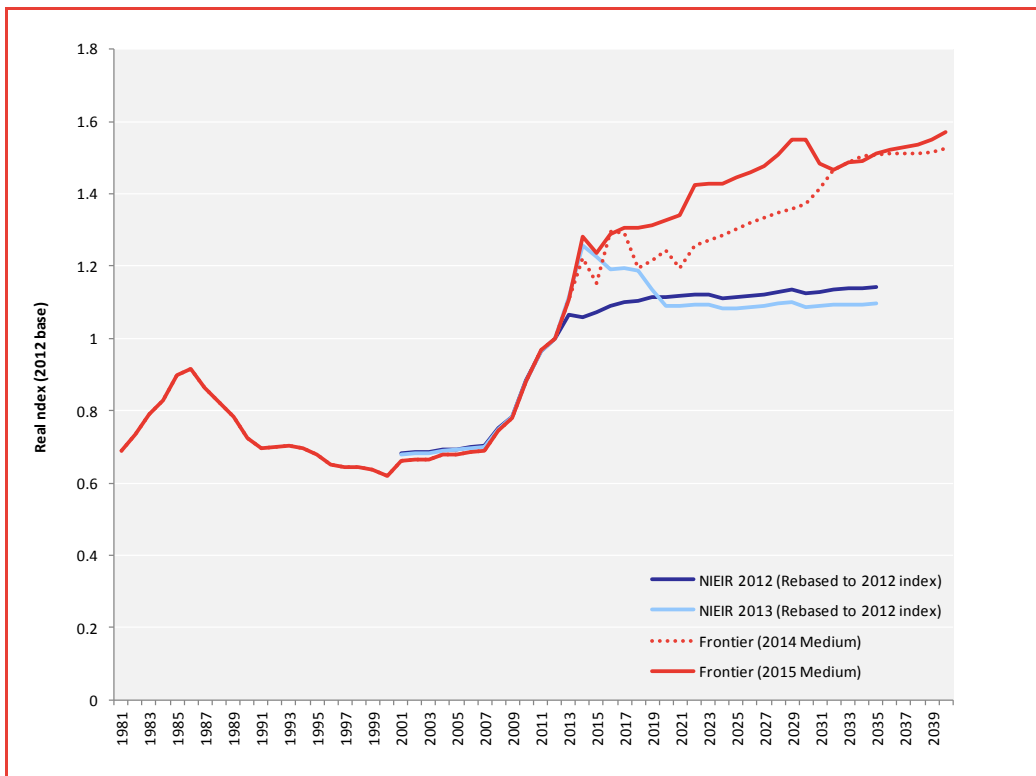
3.5 NSW and ACT

3.5.1 Historical: residential

Figure 19 shows an estimate of the historical retail residential electricity price in NSW, applying different methodologies and sources. In NSW price were relatively steady (in nominal terms) until around 2000, but have escalated rapidly since then, particularly over the past 6-7 years as network costs have risen.

Figure 19 Electricity: Historical residential retail, NSW and ACT, nominal c/kWh

Source: CPI refers to state electricity CPI from ABS 2014 Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). AEMC 2013 refers to 2013 Residential Price Trends, Dec 2013 http://www.aemc.gov.au/Media/docs/2013-Residential-Electricity-Price-Trends-Final-Report-723596d1-fe66-43da-aeb6-1ee16770391e-0.PDF
*AEMC 2012 refers to Possible future retail electricity price movements: 1 July 2012 to 30 June 2015, Mar 2013, http://www.aemc.gov.au/Media/docs/ELECTRICITY-PRICE-TRENDS-FINAL-REPORT-609e9250-31cb-4a22-8a79-60da9348d809-0.PDF.*
* AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx*

3.5.2 Historical: Business

Figure 20 compares this estimate of business electricity prices against residential. These were relatively similar (in nominal terms) from 1980-2000 but have diverged significantly since 2000 as residential prices have risen more rapidly.

Retail electricity forecasts to 2039/40   Final

Figure 20 Electricity: Historical business and residential retail, NSW and ACT, nominal c/kWh
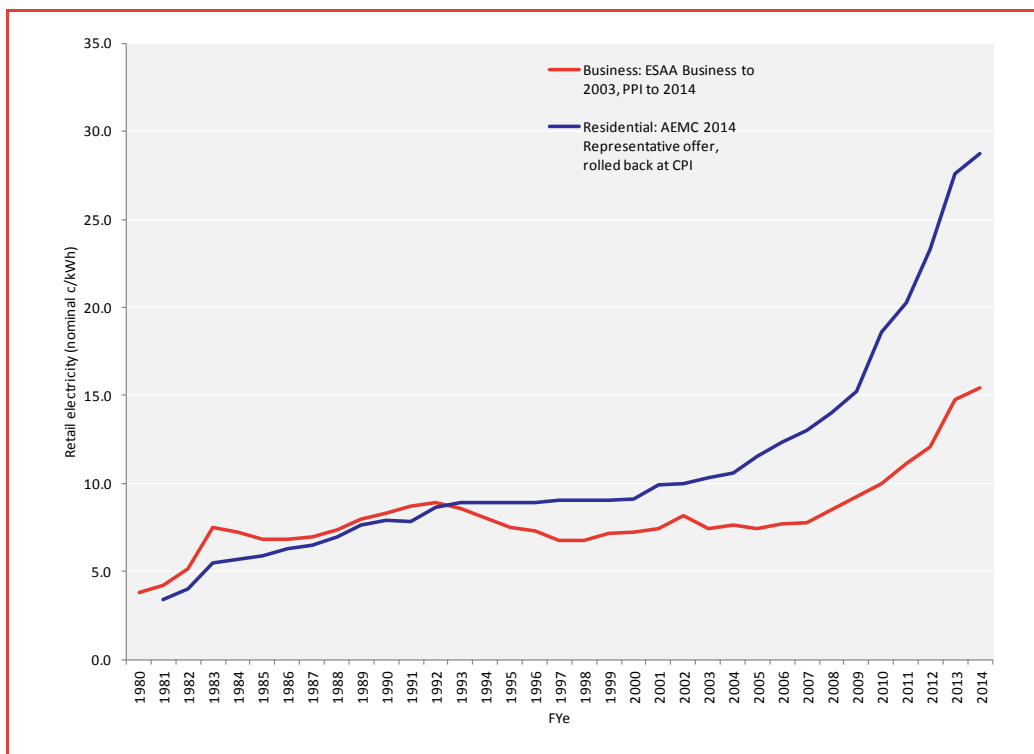
Source: CPI refers to state electricity CPI from ABS 2014Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). PPI refers to ABS 6427.0 Producer Price Indexes, Australia, Table 13. (electricity). AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx

3.5.3 Results: comparisons of scenarios

Figure 21 presents the historical residential prices against our projections for each scenario as an index. The following key results are evident:

○ Historically, residential prices had been flat in real terms until around 2007;

○ Prices increased rapidly from 2007-2013, largely due to rising network costs;

○ A further increase is evident in FYe2013 when the carbon price was introduced though prices fell from FYe2014 to FYe2015 due to the removal of the carbon price.

○ In the Medium case, projected retail prices are relatively flat in real terms until around 2040. This is because it takes a long time until the expected rise in wholesale/green costs in the long run offsets the initial sharp falls due to removing the carbon price and the AER Draft determinations on network costs.

○ Currently, wholesale prices are very low. This is due to weak demand growth and a ramping up of renewable investment to meet the renewable energy target (LRET);

- As demand eventually recovers the demand/supply balance can be expected to tighten;

- Gas prices are projected to rise over time, contributing to higher generation costs. This is largely driven by the introduction of export LNG markets in the eastern states in Qld from around 2015;

- After the initial removal of the carbon prices (which contributes to the initial fall), this is expected to contribute once again to rising prices post-2020.

○ Comparing the different scenarios:

- Section 2.4 explains that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. Low demand will <u>cause</u> lower prices, but higher supply costs in the Low scenario will cause higher prices (which in turn should cause lower demand).

- **In the scenarios modelled, supply-side effects are expected to dominate in the short and long-run**. The "Low" demand scenario includes higher cost estimates, and this flows through to higher retail prices then the other scenarios, *despite* the lower demand in that scenario. Similarly, the "High" demand scenario has lower cost assumptions and these supply-side factors drive lower projected prices in the long-run, despite the higher-demand assumption.

- The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium/Base case, however this is offset by differences in network cost assumptions between the scenarios, hence *retail* price forecasts in the High Demand case remain marginally lower than the Medium Demand case. However, the variance in price projections between these scenarios (particularly the Medium and High demand) is less extreme than other states because the NSW Medium case already reflects substantially lower network costs, in line with the AER Draft Determinations.

Figure 21 Electricity: residential retail by case, NSW (Real index)
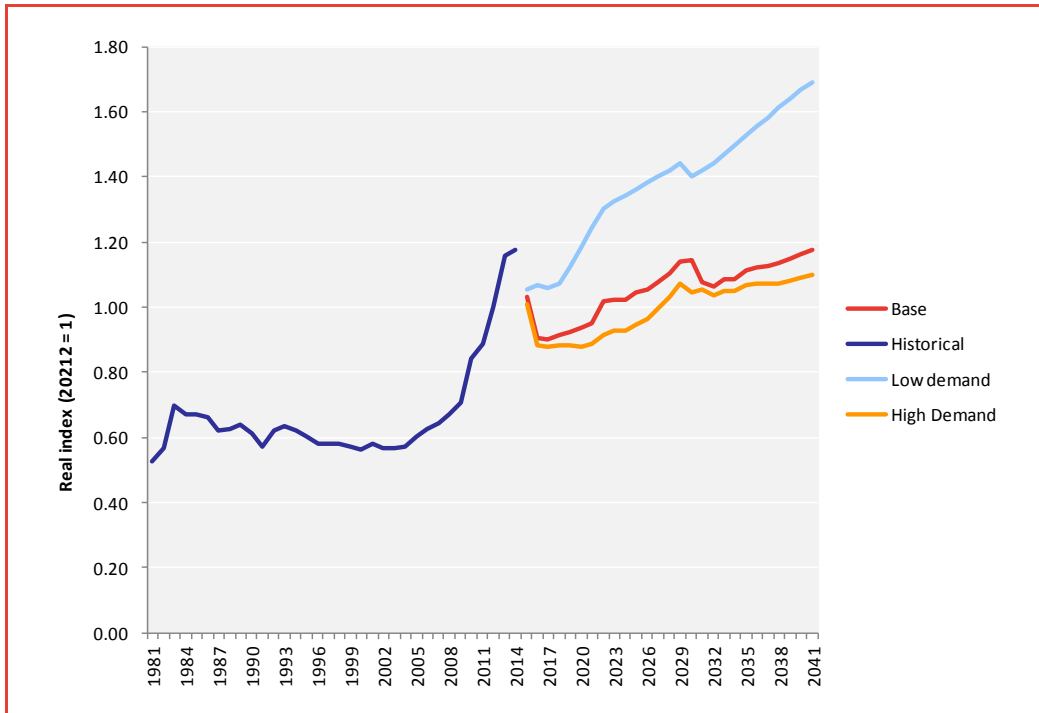
Source: Frontier Economics

Figure 22 Electricity: business retail by case, NSW (Real index)
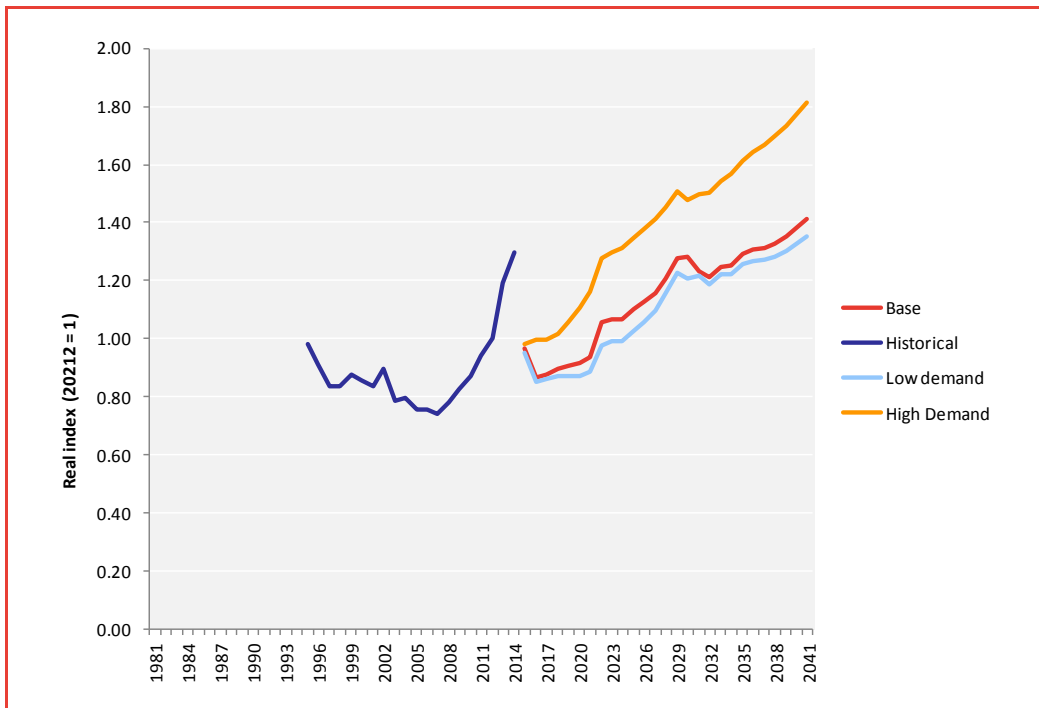
Source: Frontier Economics

3.5.4 Residential results by component

Figure 23 shows the contribution of each component to the final results in the Medium scenario. Transmission and Distribution costs fall sharply from FYe2015-2016, reflecting the most recent AER Draft determinations. Wholesale costs are expected to remain relatively flat in the short term before rising in the long-run as the demand-supply balance eventually recovers, and due to rising gas and carbon prices in the longer run. Green costs generally rise slightly as the LRET share increases to 2020 (which has an impact on volume and LRET prices). Beyond 2020, wholesale price changes mostly explain the change in retail prices.

Figure 23 Electricity: residential retail by component, NSW, Medium

Wholesale includes spot (inc carbon) + (losses, contracting etc).
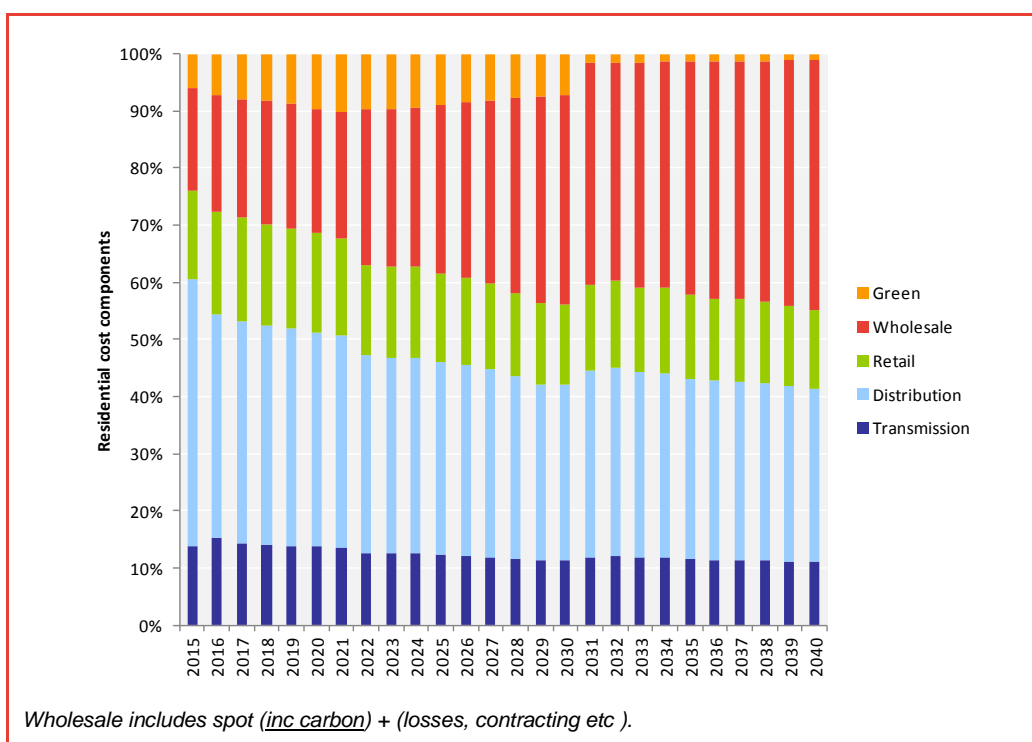
Source: Frontier Economics

Table 4 provides a summary of the total change in residential retail prices (relative to 2015) and an approximate contribution of each component to that period's change. In NSW, prices are expected to fall sharply in the short term due to falling network costs, reflecting the latest AER Draft Determinations. The AER distribution determinations are approximately 30% lower than the NSP proposals, due to lower OPEX and lower WACC assumptions. Beyond this, wholesale price changes and rising green costs (LRET) largely explain changes in the retail prices. Between FYe2015-2020, the total projected change is a fall in real terms of 9.4%. In the longer term, wholesale costs begin to rise, reflecting the tightening of the wholesale market supply-demand balance, rising fuel prices

and the assumed re-introduction of some form of carbon cost. Between 2015-2030, wholesale costs are expected to contribute to a 22.5% increase in residential retail prices. This more than offsets the short term fall in network costs, resulting in a projected net increase in retail prices of 10.6% between 2015-2030.
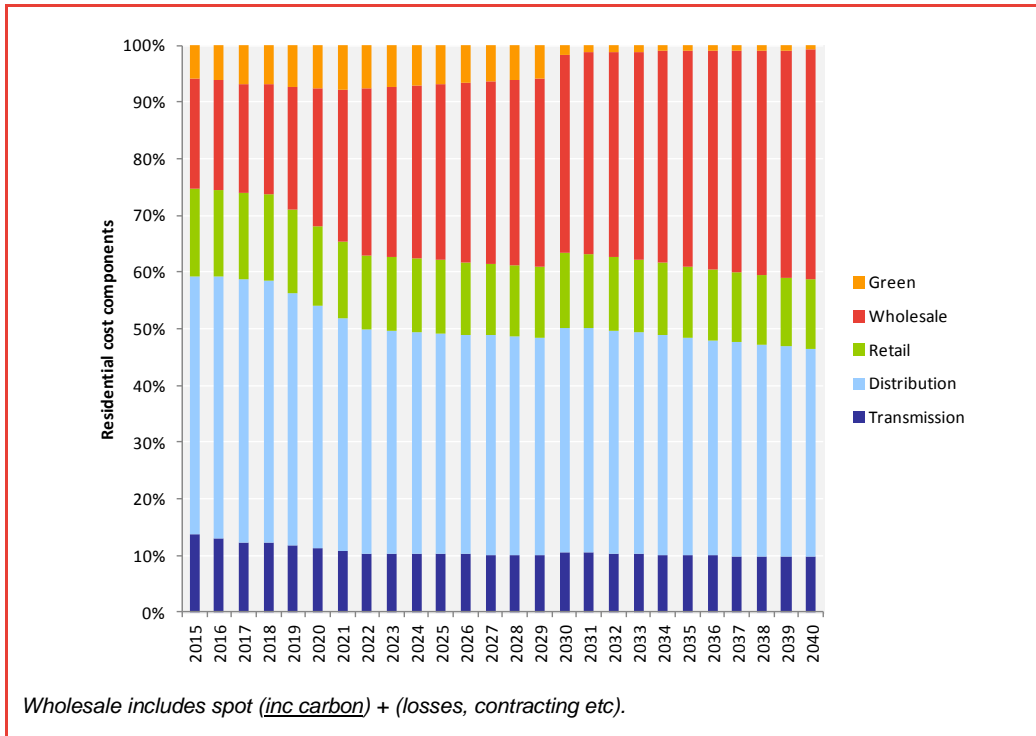
Table 4 Price change and contribution by component, NSW, real $ (Medium)

FYe	Source of change by component (contribution to total)					Total	Comment
	Trans	Dist.	Green	Retail	Whole-sale		
2015-2020	-1.4%	-12.5%	2.8%	0.1%	1.7%	-9.4%	Real prices are forecast to fall materially from 2015-2020. This is mostly due to a sharp fall in distribution network costs (particularly from 2015 to 2016 based on the AER Draft determinations). After the removal of the carbon price at the end of FY2014, wholesale costs are expected to remain relatively flat relatively flat to 2020 due to slow demand growth and the ramping up of the RET (which leads to excess supply and mitigates price increases). . Green costs increase to 2020 in line with increases in the RET, which peaks in 2020.
2015-2030	-1.4%	-12.5%	1.9%	0.1%	22.5%	10.6%	Real prices are forecast to rise above 2015 levels before 2030, even assuming that network costs fall in line with the AER draft determination. In the longer term, wholesale costs are projected to rise due to the tightening supply-demand balance as demand recovers and the RET flattens out. This more than offsets the short-term fall in network costs. Other factors contributing to the long run increases in wholesale costs are rising fuel costs (gas and coal) and the assumed reintroduction of some form of carbon cost. Green costs stabilise from 2020-2030 as the RET flattens out, and these costs reduce after 2030 as the RET is assumed to end in that year.

*Source: Frontier Economics. Note: the source of change by component reflects the percentage contribution to the change in **total** price (such that the sum of each component adds to the total change). Carbon costs are reflected in wholesale costs.*

Figure 24 and Figure 25 show the price forecasts for the Low (and High) demand scenarios by component. Rising (falling) network costs are a key driver. However, in the High demand scenario the assumed fall in network costs from 2015/16 are the same as was assumed for the Medium scenario; the difference in this instance is the long-run assumption that network costs will fall slightly in real terms over time.

Final   Retail electricity forecasts to 2039/40

Figure 24 Electricity: residential retail by component, NSW, Low demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).

Source: Frontier Economics

Figure 25 Electricity: residential retail by component, NSW, High demand

*Wholesale includes spot (inc carbon) + (losses, contracting etc).*
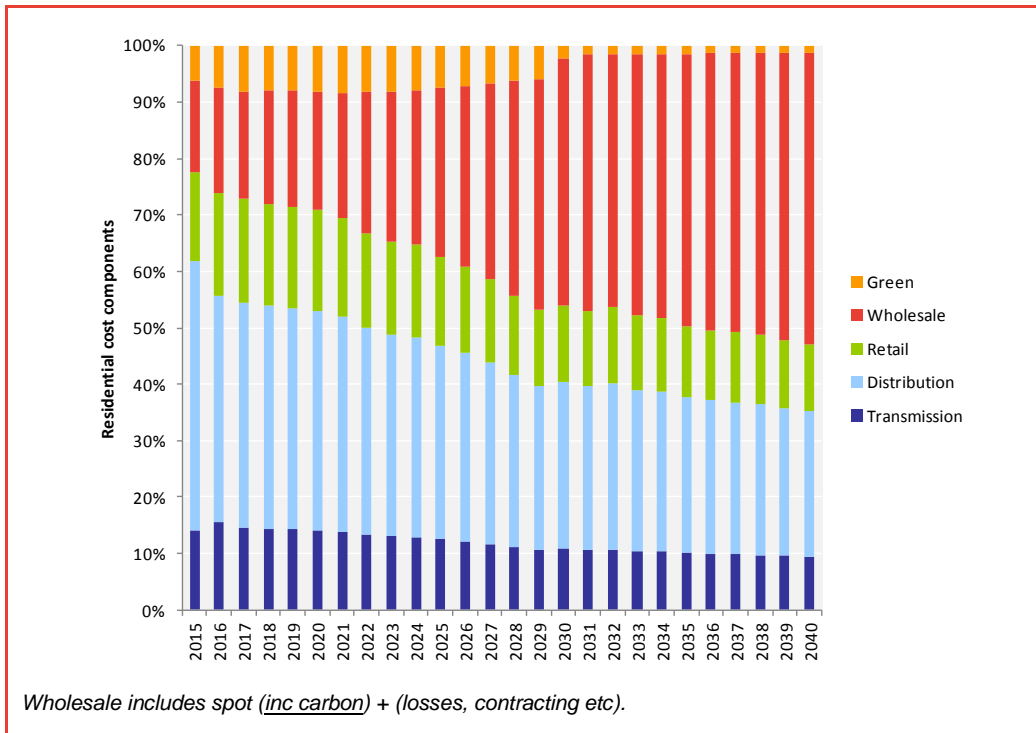
Source: Frontier Economics

3.5.5 Comparisons: alternate sources

Figure 26 presents a comparison of current and previous energy price projections used as inputs into AEMO's demand forecasts, as real indices rebased to 2012=100. The most notable difference in the 2015 Frontier projection (compared with 2014) is the material fall in network costs in 2016, reflecting the AER draft determination for the next regulatory period. This results in lower forecasts than in 2014 though out the projection period.

The 2015 forecast also reflects an updated assumption regarding the end of the LRET scheme in 2030 which results in a dip in the index in 2031 in the latest forecast compared with the 2014 forecast. The current legislation has the target ending in 2030 and we have assumed that this will not be extended, hence LRET costs are expected to fall to zero from 2031 in line with the end of the scheme. For the 2014 forecasts we implicitly assumed that the target would be extended to enable renewable projects built from 2020 onwards to earn more than ten years of LGC revenue (to better reflect project life spans).

Figure 26 Electricity: residential retail, NSW, real index, compared with previous projections
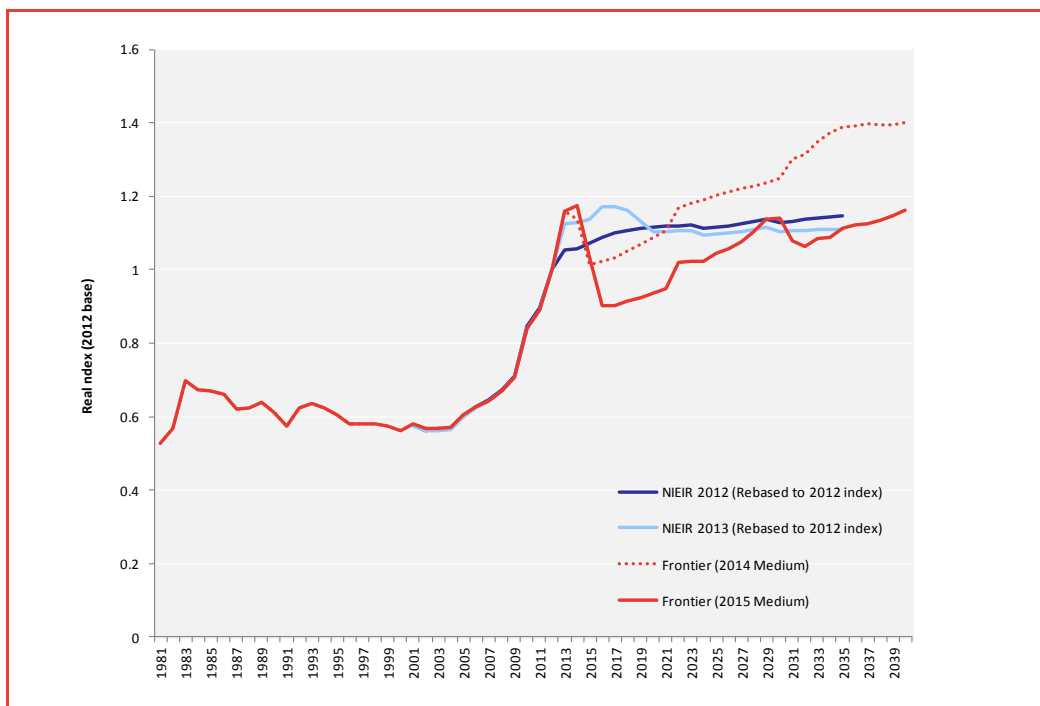
3.6   Victoria

3.6.1   Historical: residential

Figure 27 shows an estimate of the historical retail residential electricity price in VIC, applying different methodologies and sources. In VIC (as with most states) price were relatively steady in nominal terms until around 2000, but have escalated rapidly since then, particularly over the past 6-7 years as network costs have risen.

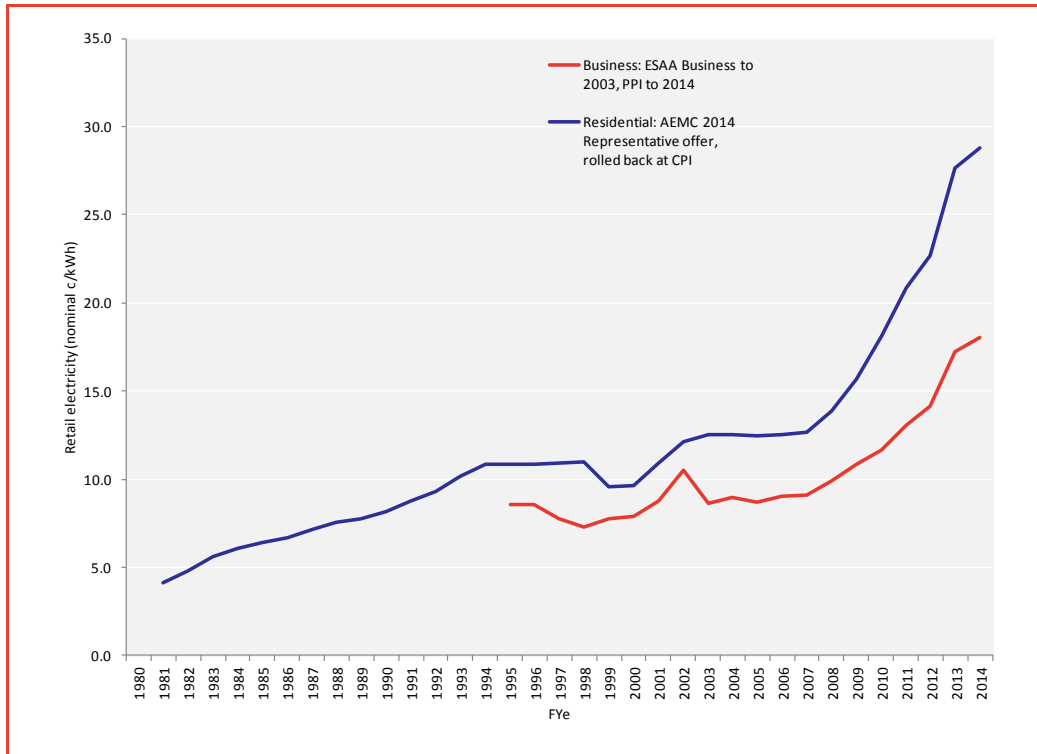Figure 27 Electricity: Historical residential retail, VIC, nominal c/kWh

Source: CPI refers to state electricity CPI from ABS 2014 Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). AEMC 2013 refers to 2013 Residential Price Trends, Dec 2013 http://www.aemc.gov.au/Media/docs/2013-Residential-Electricity-Price-Trends-Final-Report-723596d1-fe66-43da-aeb6-1ee16770391e-0.PDF
AEMC 2012 refers to Possible future retail electricity price movements: 1 July 2012 to 30 June 2015, Mar 2013, http://www.aemc.gov.au/Media/docs/ELECTRICITY-PRICE-TRENDS-FINAL-REPORT-609e9250-31cb-4a22-8a79-60da9348d809-0.PDF.
AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx

3.6.2   Historical: Business

Figure 28 compares this estimate of business electricity prices against residential. These were relatively similar (in nominal terms) from 1995-2000 but have diverged significantly since 2000 as residential prices have risen more rapidly.

Retail electricity forecasts to 2039/40   Final

Figure 28 Electricity: Historical business and residential retail, VIC, nominal c/kWh

Source: CPI refers to state electricity CPI from ABS 2014Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years). PPI refers to ABS 6427.0 Producer Price Indexes, Australia, Table 13. (electricity). AEMC 2014 refers to: http://www.aemc.gov.au/getattachment/ae5d0665-7300-4a0d-b3b2-bd42d82cf737/2014-Residential-Electricity-Price-Trends-report.aspx

3.6.3 Results: comparisons of scenarios

- The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium case, however this is more than offset by differences in network cost assumptions between the scenarios. In the High demand case, network costs are assumed to fall by a similar amount to the AER Draft Determinations for NSW, hence *retail* price forecasts in the High Demand case are consistently lower than the Medium Demand case.

Figure 29 presents the historical residential prices against our projections for each scenario as an index. The following key results are evident:

- Historically, residential prices had been flat in real terms until around 2007;

- Prices increased rapidly from 2007-2013, largely due to rising network costs;

- A further increase is evident in FYe2013 when the carbon price was introduced though prices fell from FYe2014 to FYe2015 due to the removal of the carbon price.

○ In the Medium case projected retail prices dip/are relatively flat until around 2019 and then continue to rise in the longer term. This is because network costs are expected to stabilise/flatten, but wholesale/green costs are expected to rise.

- Currently, wholesale prices are very low. This is due to weak demand growth and a ramping up of renewable investment to meet the renewable energy target (LRET);

- As demand eventually recovers, the demand/supply balance can be expected to tighten;

- Gas prices are projected to rise over time, contributing to higher generation costs. This is driven by the introduction of export LNG markets in the eastern states in Qld from around 2015;

- After the initial removal of the carbon prices (which contributes to the initial fall), this is expected to contribute once again to rising prices post-2020.

○ Comparing the different scenarios:

- Section 2.4 explains that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. Low demand will <u>cause</u> lower prices, but higher supply costs (in the Low scenario) will cause higher prices (which in turn should cause lower demand).

- **In the scenarios modelled, supply-side effects are expected to dominate in the short and long-run**. The "Low" demand scenario includes higher cost estimates, and this flows through to higher retail prices then the other scenarios, *despite* the lower demand in that scenario. Similarly, the "High" demand scenario has lower cost assumptions and these supply-side factors drive lower projected prices in the long-run, despite the higher-demand assumption.

- The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium case, however this is more than offset by differences in network cost assumptions between the scenarios. In the High demand case, network costs are assumed to fall by a similar amount to the AER Draft Determinations for NSW, hence *retail* price forecasts in the High Demand case are consistently lower than the Medium Demand case.

Figure 29 Electricity: residential retail by case, VIC (Real index)
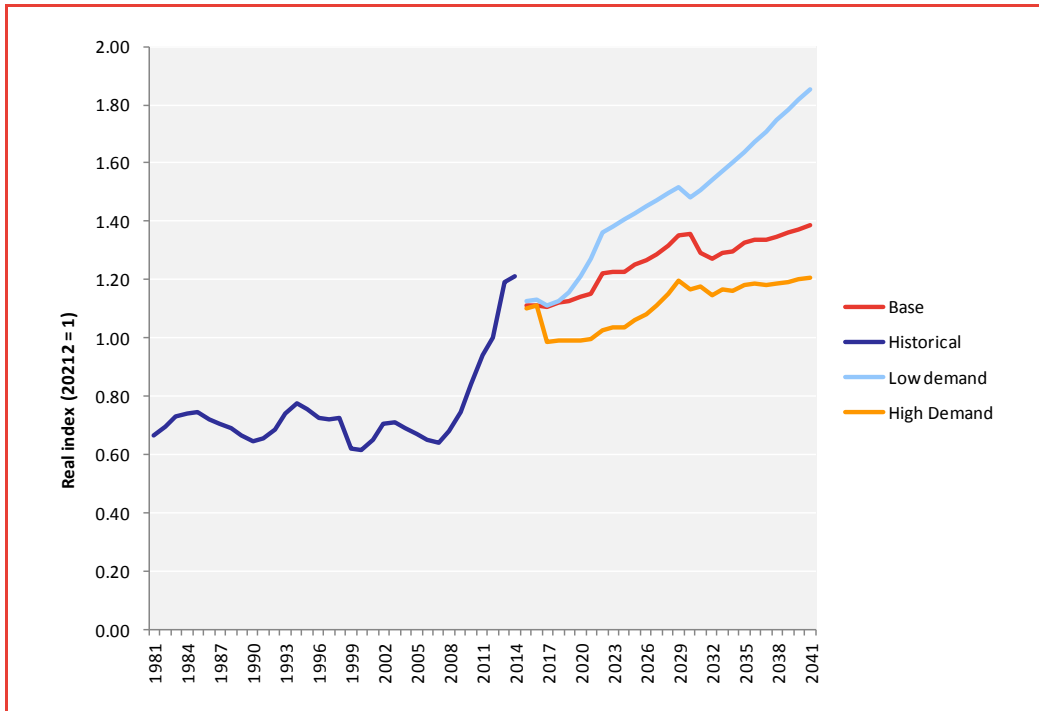
Source: Frontier Economics

Figure 30 Electricity: business retail by case, VIC (Real index)
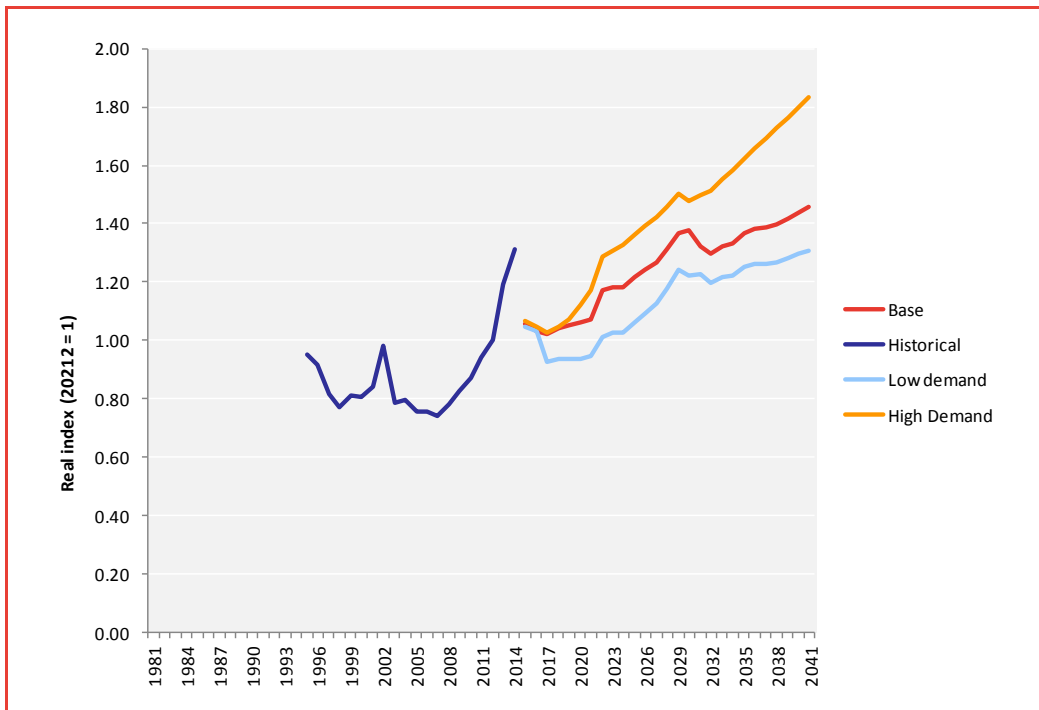
Source: Frontier Economics

3.6.4 Residential results by component

Figure 31 shows the contribution of each component to the final results in the Medium scenario. Prices are relatively flat from FYe2015 until around 2022. Distribution costs are expected to rise marginally from FYe2015-2016 and then assumed to stabilise in real terms. Wholesale costs are projected to expected to remain relatively flat until 2020 but rise in the long-run as the demand-supply balance eventually recovers and gas and carbon prices rise in the longer run. Green costs generally rise slightly as the LRET share increases to 2020 (which has an impact on volume and LRET prices). Beyond 2020, wholesale price changes mostly explain the change in retail prices.

Figure 31 Electricity: residential retail by component, VIC, Medium

Wholesale includes spot (inc carbon) + (losses, contracting etc).
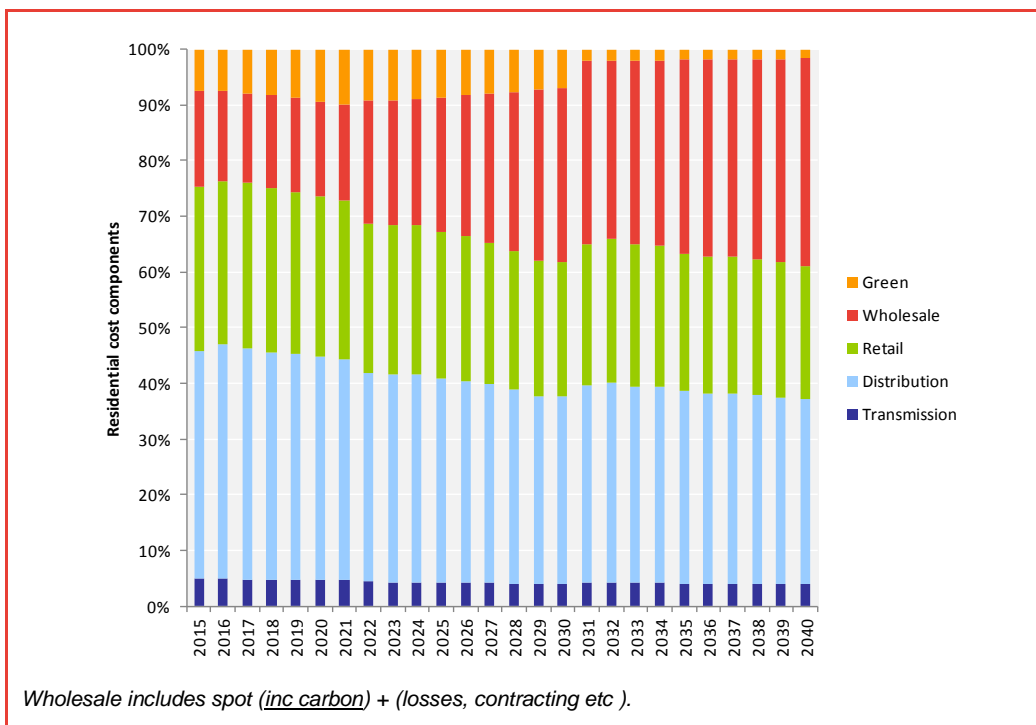
Source: Frontier Economics

Table 5 provides a summary of the total change in residential retail prices (relative to 2015) and an approximate contribution of each component to that period's change. Between FYe2015-2020, the total projected change is a rise in real terms of 2.4%. This is mostly due to a rise in green costs. This is based on the assumption that network costs will remain relatively stable, though at the time of this report there were no VIC DNSP proposals (or AER Draft determination) yet available for the next regulatory period. In the longer run to 2030, wholesale costs continue to rise due to tightening supply/demand balance and rising fuel costs. This contributes to a sustained rise in total retail costs of around 22.1% relative to 2015.

Retail electricity forecasts to 2039/40   Final

Table 5 Price change and contribution by component, Vic, real $ (Medium)

FYe	Source of change by component (contribution to total)					Total	Comment
	Trans	Dist.	Green	Retail	Whole-sale		
2015-2020	-0.2%	0.2%	2.1%	0.1%	0.1%	2.4%	Real prices are forecast to marginally increase from 2014-2020. This is mostly due to an assumed rise in network costs, and the ramping up of the RET target, which peaks in 2020. These increases are more than offset by falling wholesale costs in the short term, largely due to the removal of the carbon price. Wholesale costs otherwise remain relatively flat to 2020 due to slow demand growth and the ramping up of the RET (which leads to excess supply and mitigates price increases).
2015-2030	-0.2%	0.2%	1.0%	0.1%	21.0%	22.1%	Real prices are forecast to increase by around 12.4% from 2014-2030. The contribution of network costs to this increase in small. In the longer term, the biggest contributing factor is projected to be increases in wholesale costs, mostly after 2020. This is due to tightening supply-demand balance as demand recovers and the RET flattens out. Other factors contributing to the wholesale cost increases are rising fuel costs (gas and coal) and the assumed reintroduction of some form of carbon cost. Green costs stabilise from 2020-2030 as the RET flattens out, and these costs reduce after 2030 as the RET is assumed to end in that year.

*Source: Frontier Economics. Note: the source of change by component reflects the percentage contribution to the change in **total** price (such that the sum of each component adds to the total change. Carbon costs are reflected in wholesale costs.*

Figure 32 and Figure 33 show the price forecasts for the Low (and High) demand scenarios by component. Rising (falling) network costs are a key driver. However, in the High demand scenario some of the fall in network costs is offset by increases in expected wholesale costs as higher demand factors partly offsets the fall in assumed supply costs.

Figure 32 Electricity: residential retail by component, VIC, Low demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).
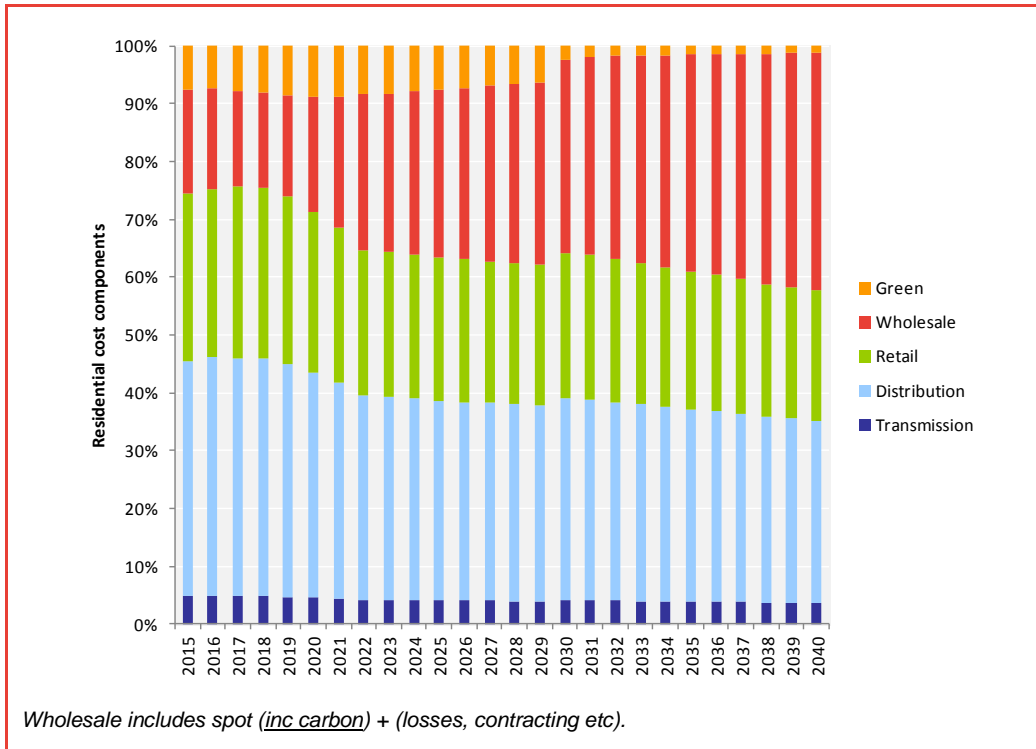
Source: Frontier Economics

Figure 33 Electricity: residential retail by component, VIC, High demand

*Wholesale includes spot (inc carbon) + (losses, contracting etc).*
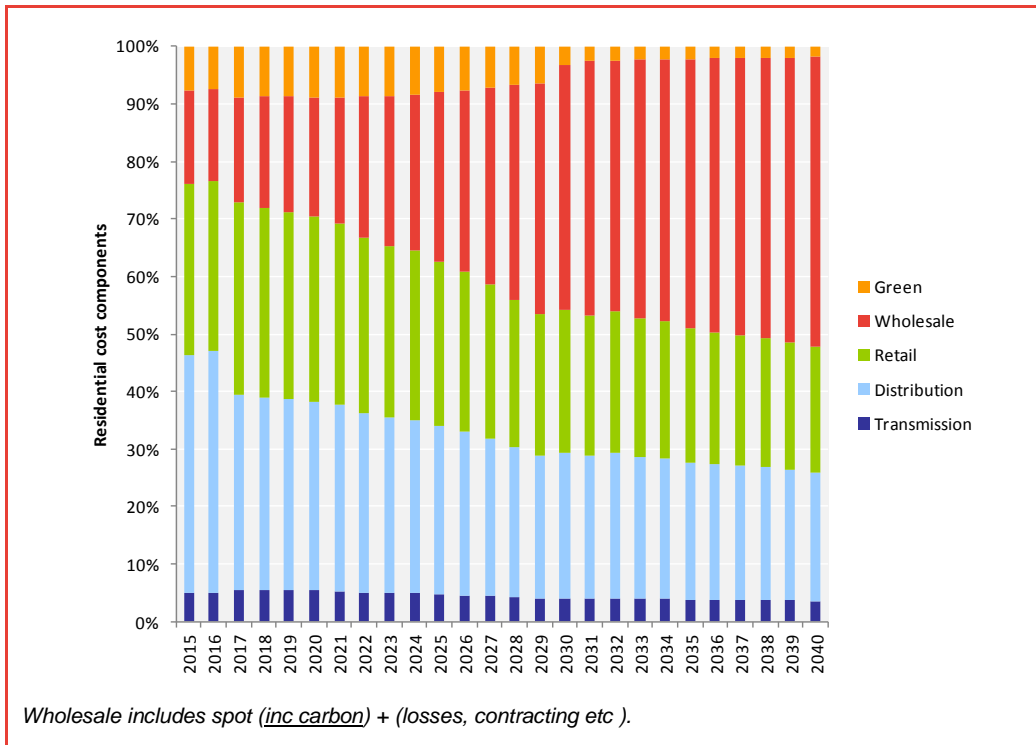
Source: Frontier Economics

3.6.5 Comparisons: alternate sources

Figure 34 presents a comparison of current and previous energy price projections used as inputs into AEMO's demand forecasts, as real indices rebased to 2012=100. The 2015 Frontier projections reflect similar assumptions regarding future network costs as 2014 and the wholesale cost forecasts are broadly similar until 2030. Future wholesale costs post-2030 are projected to be marginally lower than in the 2014 forecasts, reflecting updated fuel and demand assumptions.

The 2015 forecast also reflects an updated assumption regarding the end of the LRET scheme in 2030 which results in a dip in the index in 2031 in the latest forecast compared with the 2014 forecast. The current legislation has the target ending in 2030 and we have assumed that this will not be extended, hence LRET costs are expected to fall to zero from 2031 in line with the end of the scheme. For the 2014 forecasts we implicitly assumed that the target would be extended to enable renewable projects built from 2020 onwards to earn more than ten years of LGC revenue (to better reflect project life spans).

Figure 34 Electricity: residential retail, VIC, real index, compared with previous projections
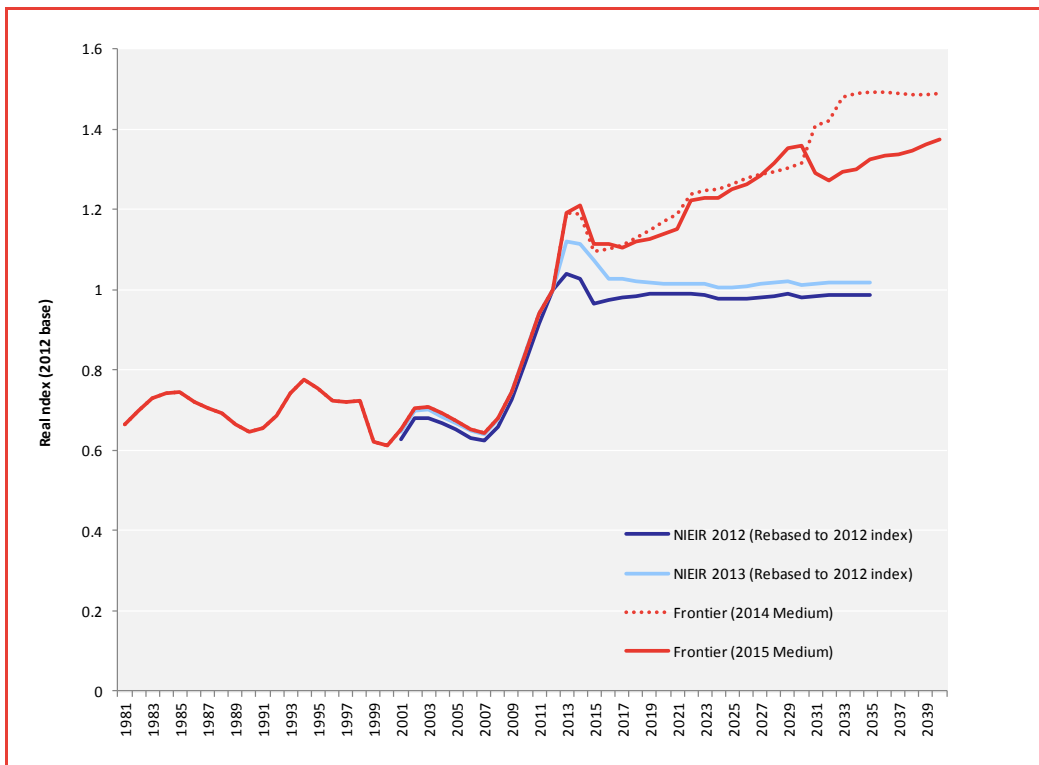
3.7   South Australia

3.7.1   Historical: residential

Figure 35 shows an estimate of the historical retail residential electricity price in SA, applying different methodologies and sources. In SA (as with most states) price were relatively steady in nominal terms until around 2000, but have escalated rapidly since then, particularly over the past 6-7 years as network costs have risen.

Figure 35 Electricity: Historical residential retail, SA, nominal c/kWh

3.7.2   Historical: Business

Figure 37 compares this estimate of business electricity prices against residential. These were relatively similar (in nominal terms) from 1995-2000 but have diverged since 2000 as residential prices have risen more rapidly.

Figure 36 Electricity: Historical business and residential retail, SA, nominal c/kWh
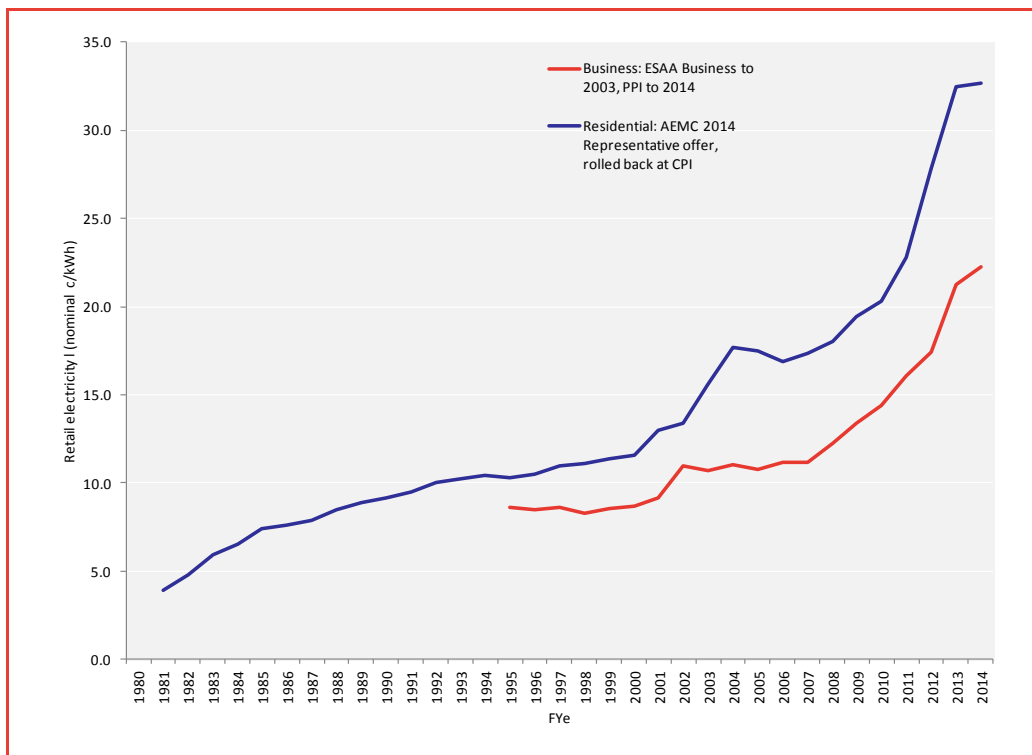
3.7.3 Results: comparisons of scenarios

Figure 37 presents the historical residential prices against our projections for each scenario as an index. The following key results are evident:

○ Historically, residential prices had been flat in real terms until around 2007;

○ Prices increased rapidly from 2007-2013, largely due to rising network costs;

○ A further increase is evident in FYe2013 when the carbon price was introduced though prices fell from FYe2014 to FYe2015 due to the removal of the carbon price.

○ In general (across all scenarios) projected retail prices are relatively flat until around 2022 and then continue to rise in the longer term. This is because network costs are expected to stabilise/flatten, but wholesale/green costs are expected to recover/rise in the longer term.

   ● Wholesale prices are currently low due to slow demand growth;

   ● As demand eventually recovers, the demand/supply balance can be expected to tighten;

- Gas prices are projected to rise over time, contributing to higher generation costs. This is discussed in detail in the chapter on Gas prices, though this is largely driven by the introduction of export LNG markets in the eastern states in Qld from around 2015;

- After the initial removal of the carbon prices (which contributed to the fall from FYe2014-2015), this is expected to contribute once again to rising prices post-2020.

○ Comparing the different scenarios:

- Section 2.4 explains that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. Low demand will <u>cause</u> lower prices, but higher supply costs (in the Low scenario) will cause higher prices (which in turn should cause lower demand).

- **In the scenarios modelled, supply-side effects are expected to dominate in the short and long-run**. The "Low" demand scenario includes higher cost estimates, and this flows through to higher retail prices then the other scenarios, *despite* the lower demand in that scenario. Similarly, the "High" demand scenario has lower cost assumptions and these supply-side factors drive lower projected prices in the long-run, despite the higher-demand assumption.

- The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium/Base case, however this is more than offset by differences in network cost assumptions between the scenarios. In the High demand case, network costs are assumed to fall by a similar amount to the AER Draft Determinations for NSW, hence *retail* price forecasts in the High Demand case are consistently lower than the Medium Demand case.

Figure 37 Electricity: residential retail by case, SA (Real index)
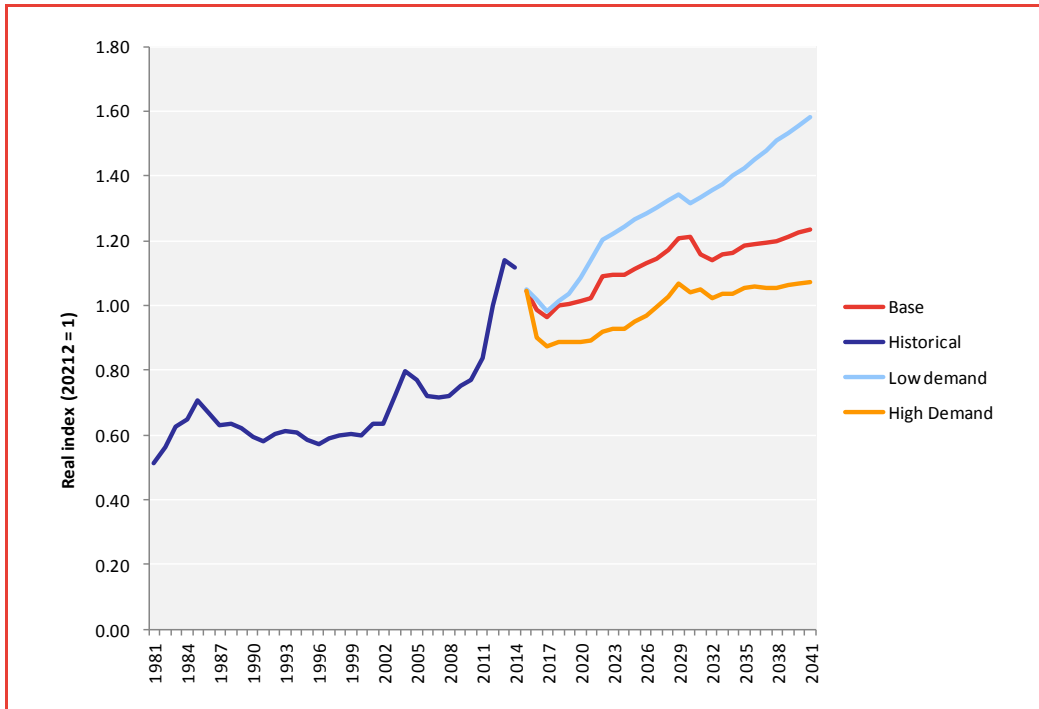
Source: Frontier Economics

Figure 38 Electricity: business retail by case, SA (Real index)
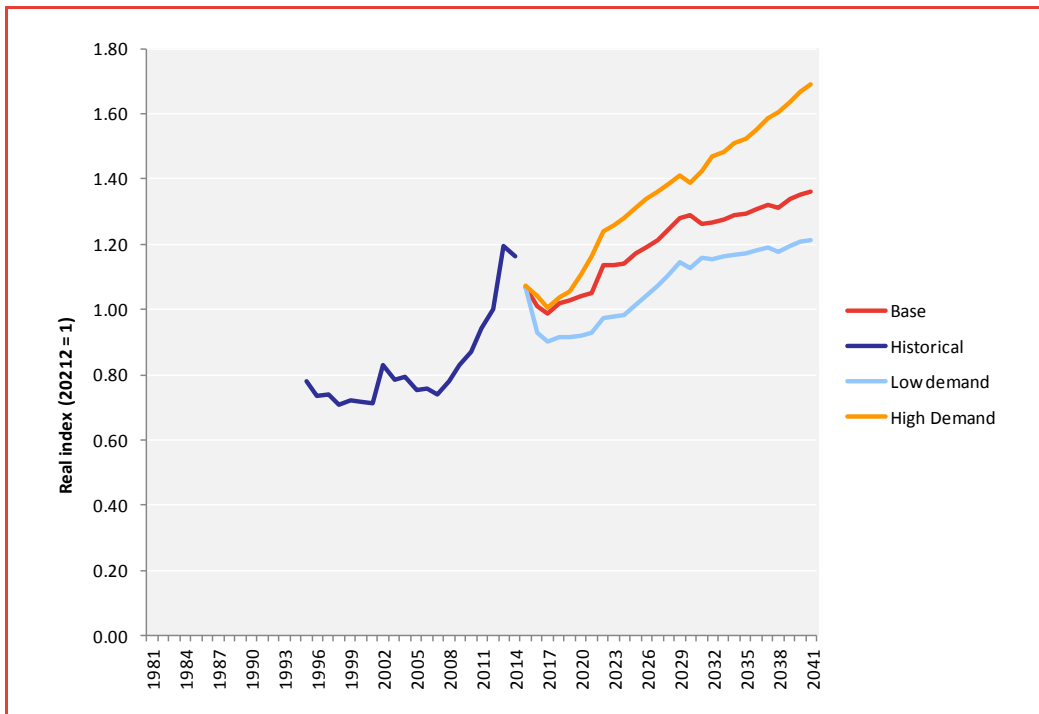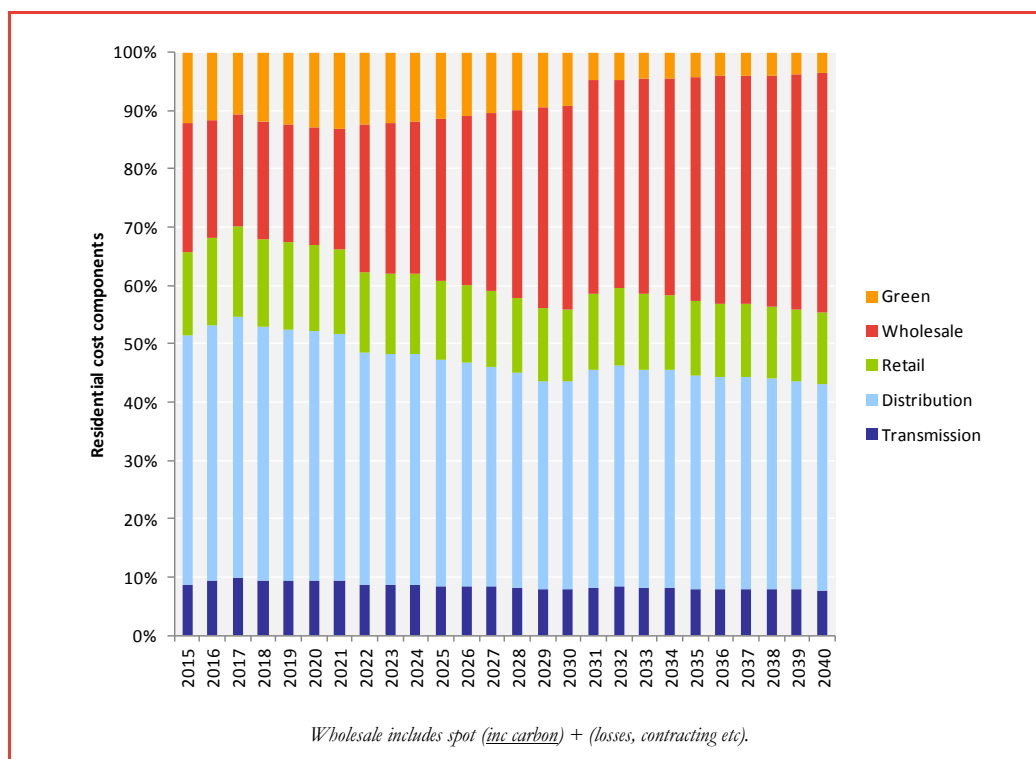

Source: Frontier Economics

3.7.4 Residential results by component

Figure 39 shows the contribution of each component to the final results in the Medium scenario. Prices are relatively flat from FYe2015 until around 2023. Distribution costs and wholesale costs are expected to remain relatively stable in real terms in the short term. Wholesale costs are otherwise expected to rise in the long-run as the demand-supply balance eventually recovers, as gas prices rise in the longer run and as some form of carbon price is assumed to have some effect on prices in the longer run. Green costs generally rise slightly as the LRET share increases to 2020 (which has an impact on volume and LRET prices). Beyond 2020, wholesale price changes mostly explain the change in retail prices.

Figure 39 Electricity: residential retail by component, SA, Medium

Wholesale includes spot (inc carbon) + (losses, contracting etc).

Source: Frontier Economics

Table 6 provides a summary of the total change in residential retail prices (relative to 2015) and an approximate contribution of each component to that period's change. Between FYe2015-2020, the total projected change is a slight fall in real terms of 3.1%. This is due to a marginal fall in wholesale and distribution costs. In the longer run to 2030, wholesale costs continue to rise due to tightening supply/demand balance and rising fuel costs. This contributes to a sustained rise in total retail costs of around 16.0% relative to 2015.

Table 6 Price change and contribution by component, SA, real $ (Medium)

FYe	Source of change by component (contribution to total)					Total	Comment
	Trans	Dist.	Green	Retail	Whole-sale		
2015-2020	0.4%	-1.4%	0.4%	0.1%	-2.5%	-3.1%	Real prices are forecast to marginally fall from 2015-2020. The ramping up of the RET target (rising green costs) is more than offset by an initial fall in network and wholesale costs in the short term. Wholesale costs otherwise remain relatively flat to 2020 due to slow demand growth and the ramping up of the RET (which leads to excess supply and mitigates price increases).
2015-2030	0.4%	-1.4%	-1.4%	0.1%	18.4%	16.0%	Real prices are forecast to increase by around 16.0% from 2015-2030. The contribution of network costs to this increase is small. In the longer term, the biggest contributing factor is projected to be increases in wholesale costs, mostly after 2020. This is due to tightening supply-demand balance as demand recovers and the RET flattens out. Other factors contributing to the wholesale cost increases are rising fuel costs (gas and coal) and the assumed reintroduction of some form of carbon cost. Green costs stabilise from 2020-2030 as the RET flattens out, and these costs reduce after 2030 as the RET is assumed to end in that year.

*Source: Frontier Economics. Note: the source of change by component reflects the percentage contribution to the change in **total** price (such that the sum of each component adds to the total change. Carbon costs are reflected in wholesale costs.*
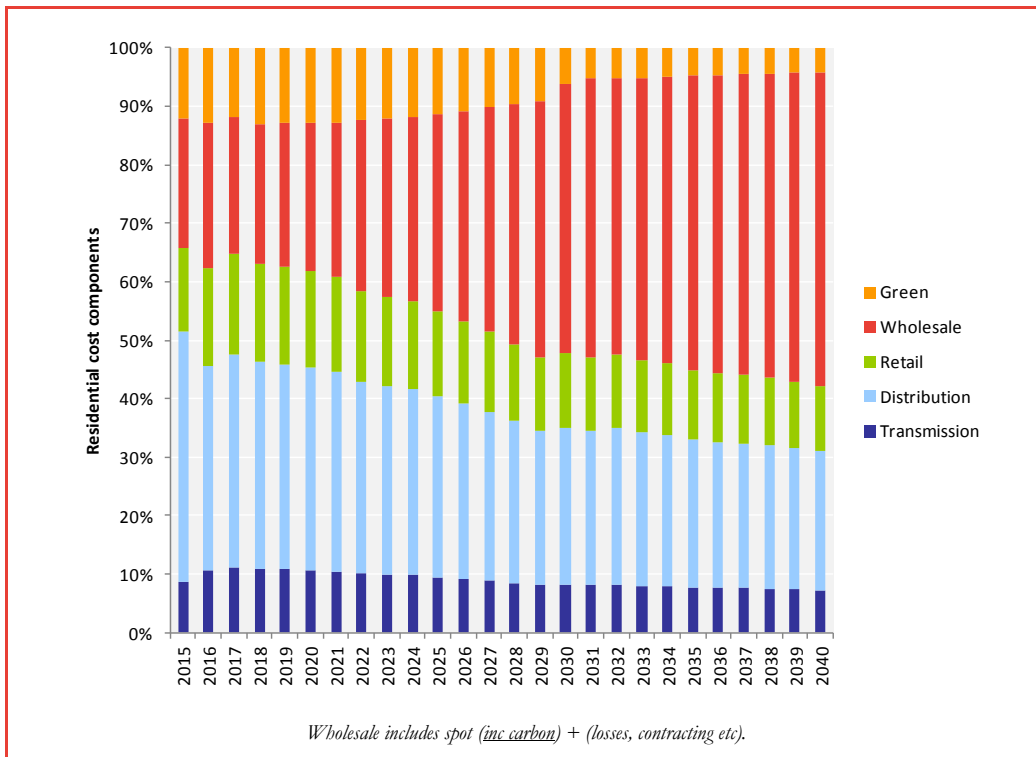
Figure 40 and Figure 41 show the price forecasts for the Low (and High) demand scenarios by component. Rising (falling) network costs are a key driver. However, in the High demand scenario some of the fall in network costs is offset by increases in expected wholesale costs as higher demand factors partly offsets the fall in assumed supply costs.

Figure 40 Electricity: residential retail by component, SA, Low demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).
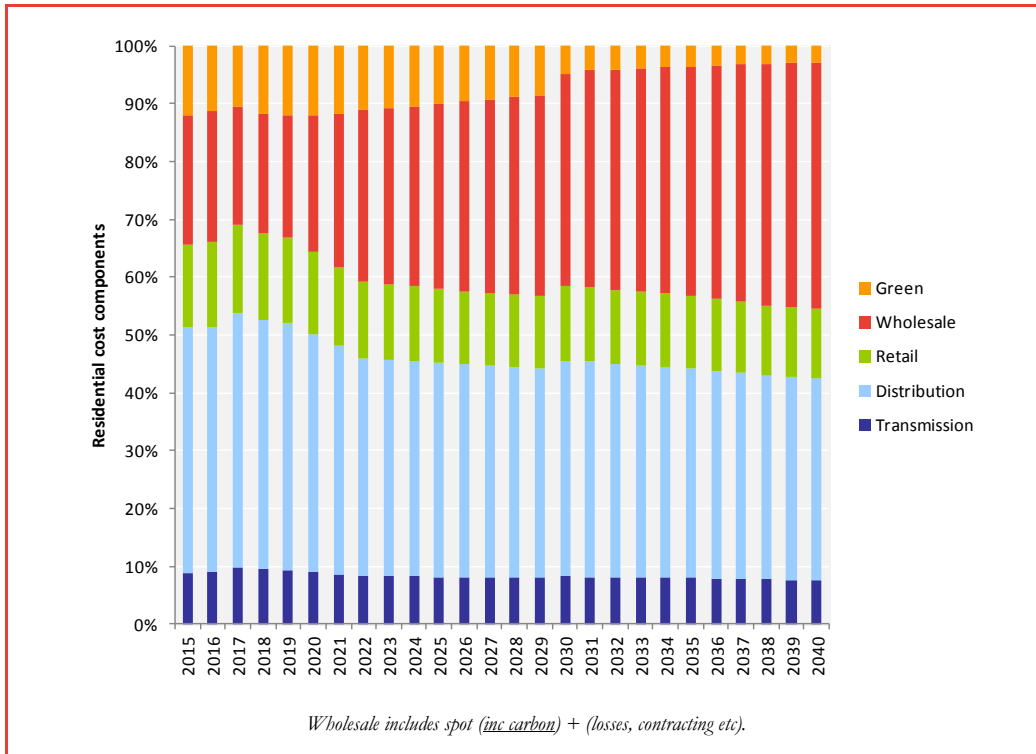
Source: Frontier Economics

Figure 41 Electricity: residential retail by component, SA, High demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).

Source: Frontier Economics

Retail electricity forecasts to 2039/40   Final

3.7.5 Comparisons: alternate sources

Figure 42 presents a comparison of current and previous energy price projections used as inputs into AEMO's demand forecasts, as real indices rebased to 2012=100. The 2015 Frontier projections reflect broadly similar assumptions regarding future wholesale and network costs as 2014, and the projections are very similar until 2030. Post-2030, green costs are expected to fall in line with a revised assumption regarding the end of the LRET in 2030 (which was not reflected in the 2014 forecasts). The current legislation has the LRET ending in 2030 and we have assumed that this will not be extended, hence LRET costs are expected to fall to zero from 2031 in line with the end of the scheme. For the 2014 forecasts we implicitly assumed that the target would be extended to enable renewable projects built from 2020 onwards to earn more than ten years of LGC revenue (to better reflect project life spans), so a similar dip was not evident.

Figure 42 Electricity: residential retail, SA, real index, compared with previous projections
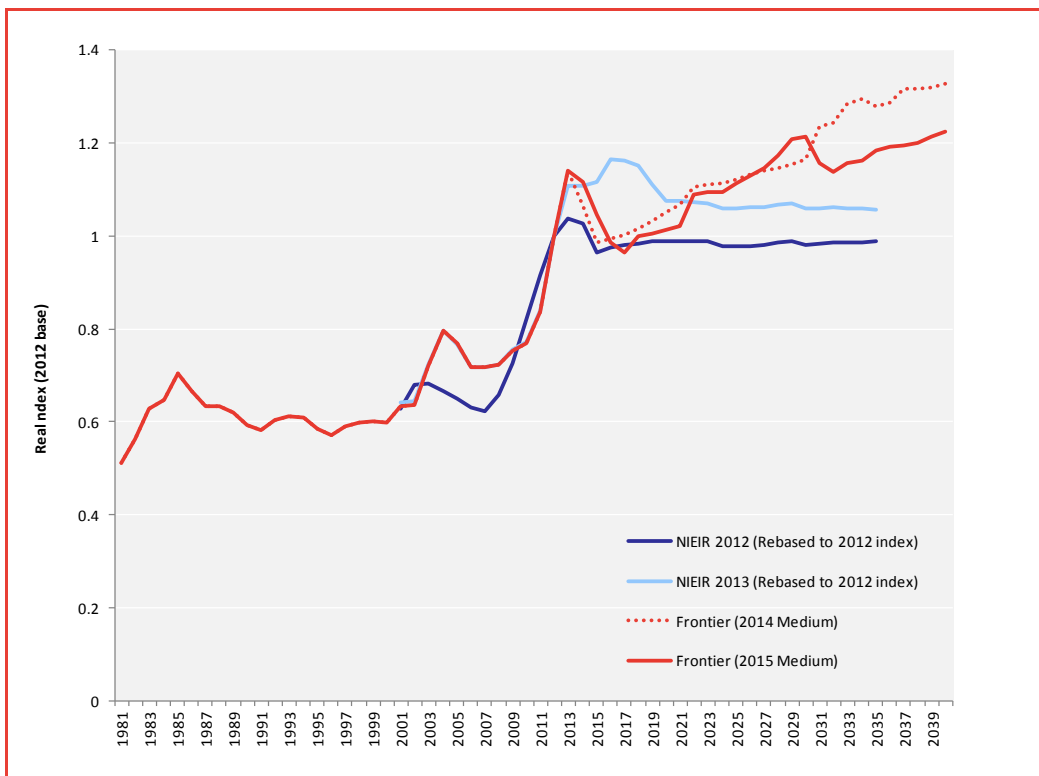
3.8   Tasmania

3.8.1   Historical: residential

Figure 43 shows an estimate of the historical retail residential electricity price in TAS, applying different methodologies and sources. In TAS price were relatively steady in nominal terms until around 2000, but have escalated rapidly since then, particularly over the past 6-7 years as network costs have risen.

Figure 43 Electricity: Historical residential retail, TAS, nominal c/kWh

3.8.2   Historical: Business

Figure 44 compares this estimate of business electricity prices against residential. These were relatively similar (in nominal terms) from 1995-2000 but have diverged since 2000 as residential prices have risen more rapidly. In general, TAS business prices (as reported by the ESAA) are much lower than other regions, suggesting generally larger business users / lower network costs.

Retail electricity forecasts to 2039/40   Final

Figure 44 Electricity: Historical business and residential retail, TAS, nominal c/kWh
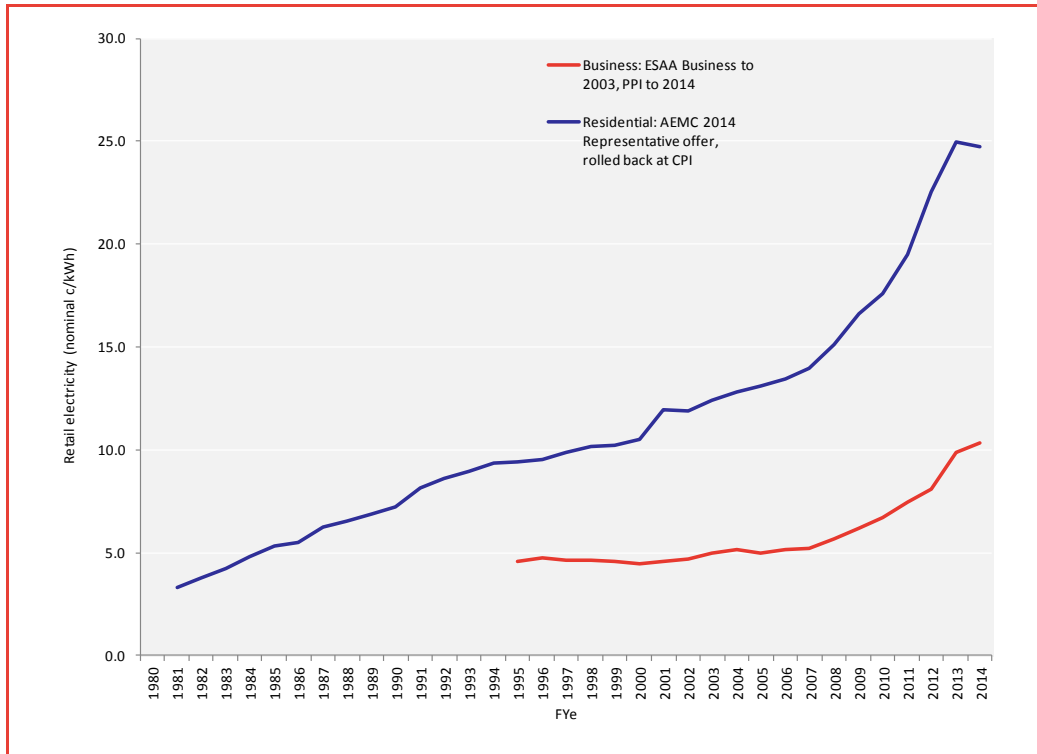
Source: CPI refers to state electricity CPI from ABS 2013Sep CPI release document 640108, Table 11. ESAA Electricity Prices in Australia (various years. AEMC 2013 refers to 2013 Residential Price Trends, Dec 2013 http://www.aemc.gov.au/Media/docs/2013-Residential-Electricity-Price-Trends-Final-Report-723596d1-fe66-43da-aeb6-1ee16770391e-0.PDF 'SO' refers to standing offer, 'Market' refers to market offer. PPI refers to ABS 6427.0 Producer Price Indexes, Australia, Table 13. (electricity)

3.8.3 Results: comparisons of scenarios

Figure 43 presents the historical residential prices against our projections for each scenario as an index. The following key results are evident:

○ Historically, residential prices had been flat in real terms until around 2007;

○ Prices increased rapidly from 2007-2013, largely due to rising network costs;

○ A further increase is evident in FYe2013 when the carbon price was introduced though prices fell from FYe2014 to FYe2015 due to the removal of the carbon price.

○ In general (across all scenarios) projected retail prices are relatively flat until around 2020 and then continue to rise in the longer term. This is because network costs are expected to fall slightly and then flatten, but wholesale/green costs are expected to fall initially and then rise in the longer run.

Final   Retail electricity forecasts to 2039/40

- Wholesale prices are currently low due to weak demand growth and a ramping up of renewable investment to meet the renewable energy target (LRET);

- As demand eventually recovers (and some existing plant reaches retirement post 2020), the demand/supply balance can be expected to tighten. This does not necessarily mean in Tasmanian (where demand growth is still flat/falling), but demand growth in other NEM regions is expected to contribute to prices in Tas (to the extent that energy can be exported from Tas).

- After the initial removal of the carbon prices (which contributes to the initial fall), this is expected to contribute once again to rising prices post-2020.

O Comparing the different scenarios:

  - Section 2.4 explains that prices may be higher or lower in the "Low demand" scenario, depending on whether demand or supply-side factors dominate. Low demand will cause lower prices, but higher supply costs (in the Low scenario) will cause higher prices (which in turn should cause lower demand).

  - **In the scenarios modelled, supply-side effects are expected to dominate in the short and long-run**. The "Low" demand scenario includes higher cost estimates, and this flows through to higher retail prices then the other scenarios, *despite* the lower demand in that scenario. Similarly, the "High" demand scenario has lower cost assumptions and these supply-side factors drive lower projected prices in the long-run, despite the higher-demand assumption.

  - The high demand sensitivity does result in higher *wholesale* cost projections than in the Medium/Base case, however this is more than offset by differences in network cost assumptions between the scenarios. In the High demand case, network costs are assumed to fall by a similar amount to the AER Draft Determinations for NSW, hence *retail* price forecasts in the High Demand case are consistently lower than the Medium Demand case.

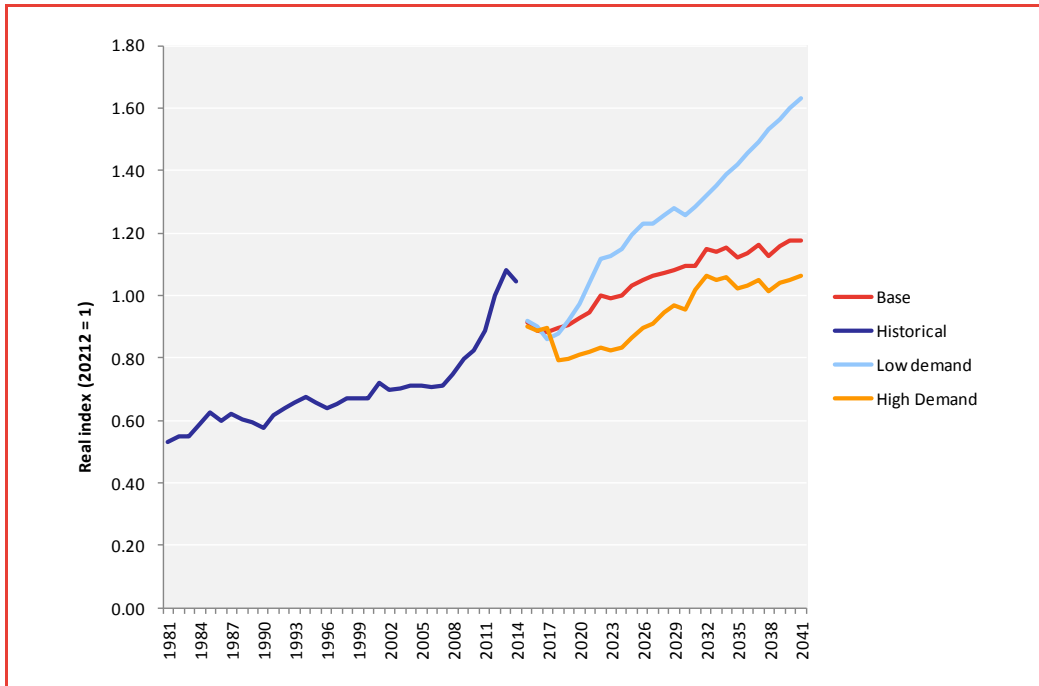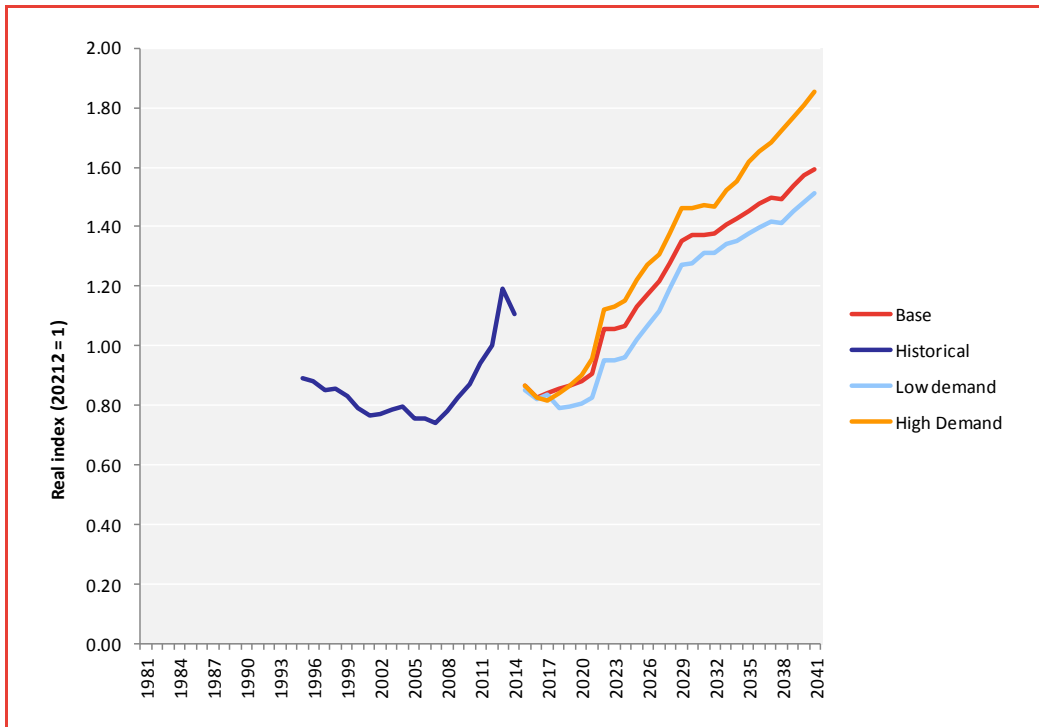Figure 45 Electricity: residential retail by case, TAS (Real index)

Figure 46 Electricity: business retail by case, TAS (Real index)

Source: Frontier Economics

Final   Retail electricity forecasts to 2039/40

3.8.4 Residential results by component

Figure 47 shows the contribution of each component to the final results in the Medium scenario. Network costs are expected to fall marginally and then assumed to stabilise in real terms. Wholesale costs are projected to remain relatively stable (and low) in the short-term. Wholesale costs are otherwise expected to rise in the long-run as the demand-supply balance eventually recovers, and due to rising gas and carbon prices in the longer run[5]. Green costs generally rise slightly as the LRET share increases to 2020 (which has an impact on volume and LRET prices). Beyond 2020, wholesale price changes mostly explain the change in retail prices. The RET is assumed to end in 2030 (as legislated), hence the fall in green costs that year.

Figure 47 Electricity: residential retail by component, TAS, Medium

Wholesale includes spot (inc carbon) + (losses, contracting etc)
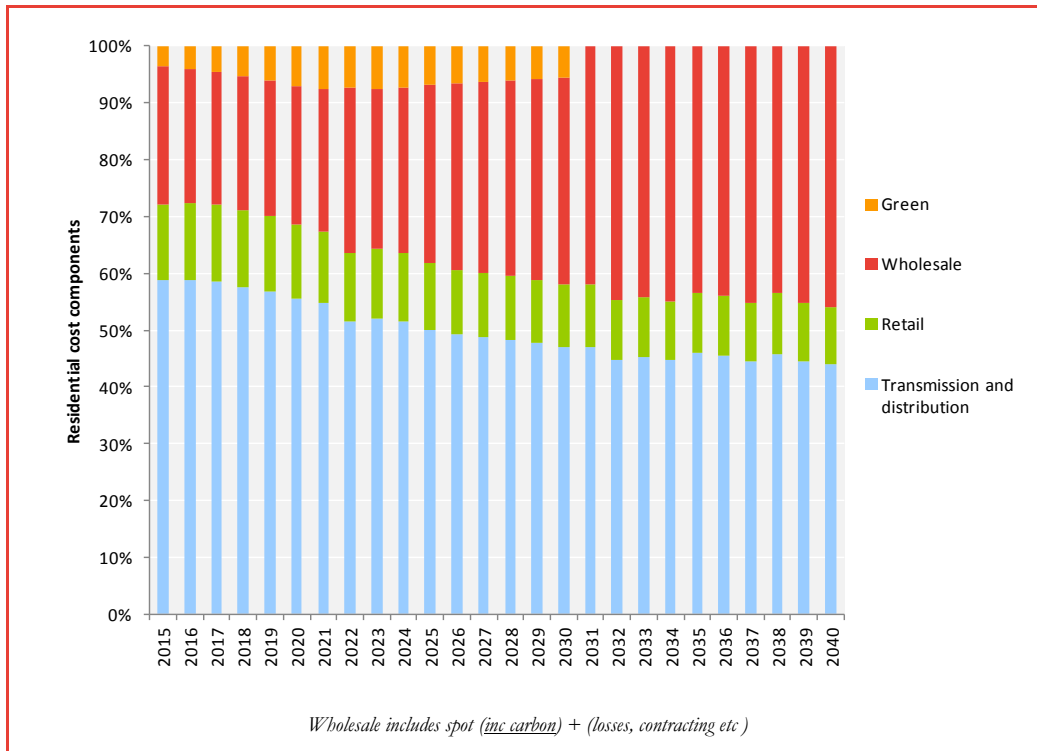
Source: Frontier Economics

Table 7 provides a summary of the total change in residential retail prices (relative to 2015) and an approximate contribution of each component to that period's change. Between FYe2015-2020, the total projected change is a rise in real terms of 1.7%. This is mostly due to the rise in green costs as the RET target ramps up to 2020, which offsets the slight fall in network costs. In the longer run

---

[5]   *It is not necessary that demand is rising in Tasmania: if prices are lower in Tasmania then exports are likely to increase and prices between regions should tend to converge unless constraints are binding and interconnect capacity is not expanded.*

to 2030, wholesale costs continue to rise due to tightening supply/demand balance (in Vic at least) and rising fuel costs. This contributes to a sustained rise in total retail costs of around 20% relative to 2015.

Table 7 Price change and contribution by component, Tas, real $ (Medium)

FYe	Source of change by component (contribution to total)				Total	Comment
	Trans Dist.	Green	Retail	Whole-sale		
2015-2020	-2.3%	3.5%	0.0%	0.4%	1.7%	Real prices are forecast to rise marginally fall from 2015-2020, mostly due to green costs as the RET increases and peaks in 2020. Wholesale costs otherwise remain relatively flat to 2020 due to slow demand growth.
2015-2030	-2.3%	3.2%	0.0%	19.1%	20.0%	Real prices are forecast to increase by around 20.0% from 2015-2030. In the longer term, the contributing factors are projected to be increases in wholesale costs (more due to demand growth in Vic than in Tas) and mostly after 2020. Other factors contributing to the wholesale cost increases are rising fuel costs (gas and coal) and the assumed reintroduction of some form of carbon cost. Green costs stabilise from 2020-2030 as the RET flattens out, and these costs reduce after 2030 as the RET is assumed to end in that year.

*Source: Frontier Economics. Note: the source of change by component reflects the percentage contribution to the change in **total** price (such that the sum of each component adds to the total change. Carbon costs are reflected in wholesale costs.*
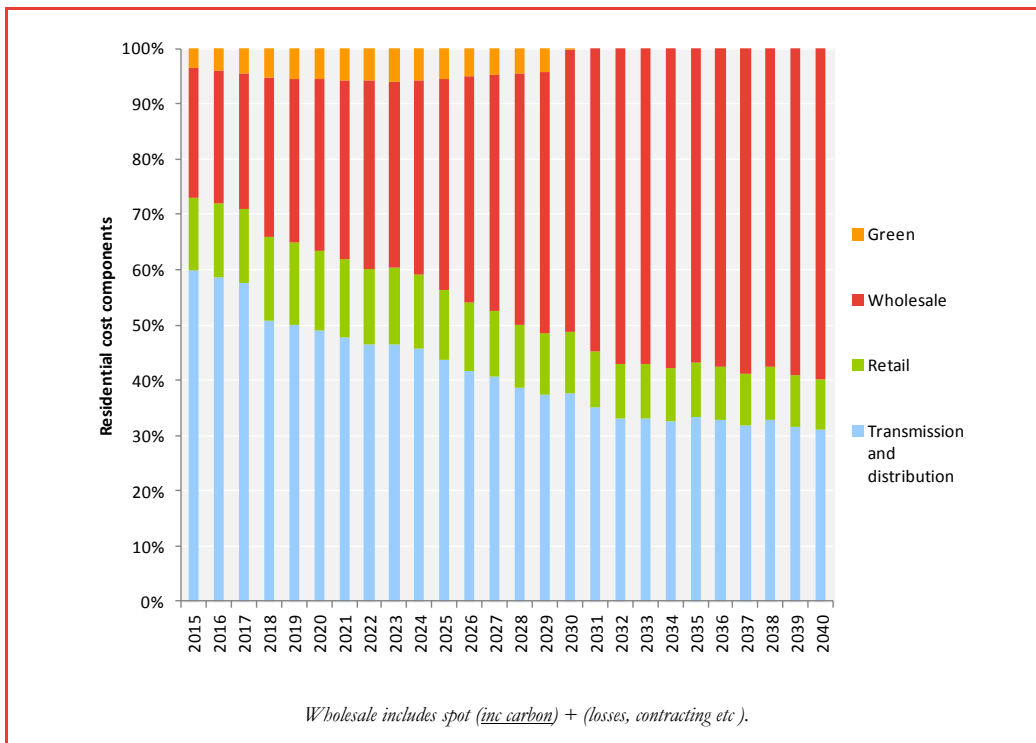
Figure 48 and Figure 49 show the price forecasts for the Low (and High) demand scenarios by component. Rising (falling) network costs are a key driver. However, in the High demand scenario some of the fall in network costs is offset by increases in expected wholesale costs as higher demand (in Vic) partly offsets the fall in assumed supply costs.

Figure 48 Electricity: residential retail by component, TAS, Low demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).
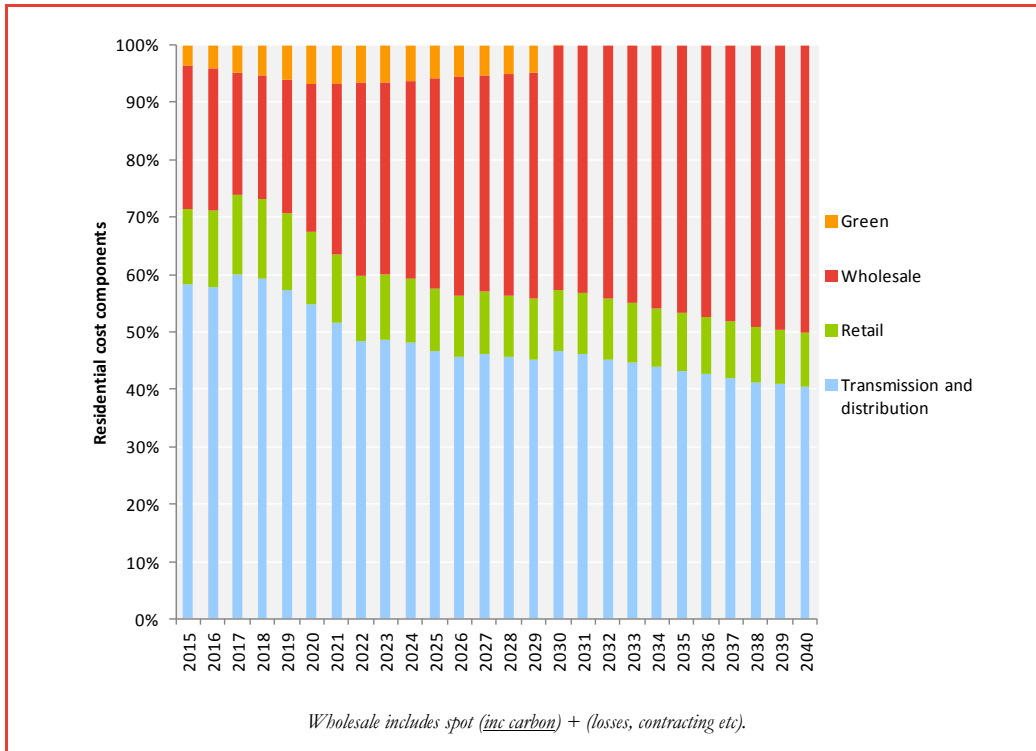
Source: Frontier Economics

Figure 49 Electricity: residential retail by component, TAS, High demand

Wholesale includes spot (inc carbon) + (losses, contracting etc).

Source: Frontier Economics

Retail electricity forecasts to 2039/40   Final

3.8.5 Comparisons: alternate sources

Figure 50 presents a comparison of current and previous energy price projections used as inputs into AEMO's demand forecasts, as real indices rebased to 2012=100. The 2015 Frontier projections reflect lower network costs assumptions in line with more recent information. Otherwise the projections are very similar until 2030. Post-2030, green costs are expected to fall in line with a revised assumption regarding the end of the LRET in 2030 (which was not reflected in the 2014 forecasts). The current legislation has the LRET ending in 2030 and we have assumed that this will not be extended, hence LRET costs are expected to fall to zero from 2031 in line with the end of the scheme. For the 2014 forecasts we implicitly assumed that the target would be extended to enable renewable projects built from 2020 onwards to earn more than ten years of LGC revenue (to better reflect project life spans).

Figure 50 Electricity: residential retail, Tas, real index, compared with previous projections

Appendix A Modelling methodologies

This section explains the methodology used by Frontier Economics to produce the Energy Market forecasts.

ELECTRICITY MARKET MODELLING: OVERVIEW OF *WHIRLYGIG*

At a high level, the electricity modelling involved detailed market modelling of the wholesale electricity market to derive wholesale market and green/LRET cost combined with estimates for future distribution, transmission and retail costs. These transmission and distribution costs are based on current NSP proposals or AER determinations as applicable (as described in the scenario descriptions).

The wholesale market modelling was conducted using one of Frontier's proprietary electricity market models: *WHIRLYGIG*. For this project, input assumptions were derived from

- Frontier's in-house assumptions; and

- AEMO's 2014 NEFR.

WHIRLYGIG assumes an efficient and competitive electricity market, where costs, prices and generator returns are determined on an optimal least-cost basis. *WHIRLYGIG* computes the least-cost mix of generation, interconnection, demand-side management and greenhouse abatement investments subject to *simultaneously*:

- matching supply to demand

- meeting a system reliability target

- meeting any policy restrictions (including, for instance, LRET and/or an emission trading scheme).

This approach involves determining the future pattern of generation investment and dispatch and hence the long run marginal cost (LRMC) of the generation system by computing the least-cost mix of future generation plant, having regard to the current stock of plant. LRMC is a proxy for market price in an efficient market. The process for determining the LRMC is well developed and understood and therefore provides a systematic and easily verifiable basis for comparing the projected electricity prices. A diagram of high level inputs/output for *WHIRLYGIG* is provided in Figure A.1.

Chart A.1: Model inputs and outputs
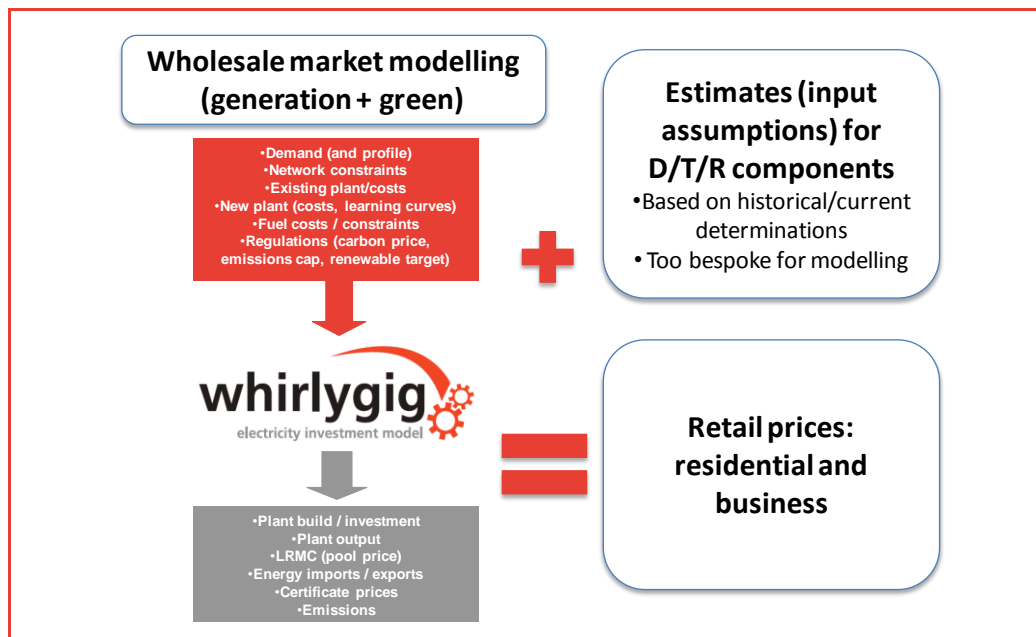
NETWORK COMPONENTS

Assumptions for distribution and transmission components until 2015/16 are based on AEMC 2014: Residential Electricity Price Trends (http://www.aemc.gov.au/Markets-Reviews-Advice/2014-Residential-Electricity-Price-Trends). This report was released December 2014 and provides a summary of all regulatory determinations consistently translated to estimates for residential retail prices. Frontier assisted the AEMC with the retail price estimates.

KEY   MODEL   INPUTS/OUTPUTS   (ELECTRICITY   MODEL: *WHIRLYGIG*)

The electricity model requires the following input data:

● New entrants' costs: As with all of the input assumptions, Frontier has an existing database of generator cost assumptions that has been developed in-house. This database includes estimates of both thermal and renewable plant in the NEM.

● Fuel cost projections.

● Variable and fixed operating and maintenance (VOM and FOM) costs.

● Electricity demand, and the 'shape' of demand over different times of the year (discussed below). In this case, the demand forecasts were derived from AEMO's 2014 NEFR. This varied by scenario.

Appendix A Modelling methodologies   Final

- Capacities and annual energy output potential: this includes resources constraints on fuel (for example gas supply and renewable potential) and constraints on carbon sink capacity (for example, regional limits on annual or cumulative carbon sequestration).

- Plant operating characteristics (such as efficiencies and heat rates).

- Plant commissioning timeframes: this refers to the availability of new investment options given technology advances and physical constraints – the model determines the optimal timing of new investments.

- A carbon price. The different carbon price assumptions are discussed in the scenarios section (as these varied by scenario).

- Renewable targets: the model includes policy constraints, including the LRET. In the model, the LRET operates as a quantity target, with provision for banking and borrowing of permits. This takes account of the pre-existing surplus of LGCs.

RESULTS: WHOLESALE ELECTRICITY COSTS

A detailed split of retail cost components (transmission, distribution etc) is provided in the body of the report. This section provides a brief summary of wholesale cost projections by state and by scenario. The spot prices are less than LRMC for many years, reflecting the current supply/demand balance (ie there is a relative excess of supply until demand grows and the LRET levels off. The wholesale energy costs below reflect spot prices (which are carbon inclusive in all cases), plus losses and contracting costs (to serve representative residential load).

SCENARIO COMPARISON, BY STATE

In all cases, an initial fall in spot prices occurred when the carbon price is assumed to be removed (FYe2015). Thereafter, prices are expected to recover/rise due to:

- Rising demand: s2.5.2 shows the demand assumptions. Although flat in many states/scenarios, demand is expected to rise in Qld, and this can have an impact on other state prices. This is particularly the case as underlying spot prices (after accounting for carbon) are at around their lowest point. In addition, some baseload plant are likely to reach the end of their technical lives after 2025 (for example, Liddell) and these retirements (capacity withdrawals) will have an effect equivalent to rising demand

- Rising supply costs: in most scenarios, carbon is expected to contribute to rising costs post 2020 (particularly in the "Low demand/high price" scenario). Also, gas prices are expected to rise in all scenarios as export markets open up in the Eastern states (LNG).

The long-run spot prices are generally highest in the "Low demand" scenario due to the higher cost assumptions which more than offset the low demand effects which, all else being equal, would cause lower prices. The wholesale costs in the Medium and High demand scenarios are similar, and some cross-over is observed. This is explained in s2.5.3: the scenario assumptions focussed on lower costs in the High demand scenario (which drives lower price forecasts, all else being equal, however the strong demand growth in this scenario causes prices to increase more quickly in the long run than in the Medium case. Stronger assumptions regarding falling supply costs would be necessary in the High demand to offset the effects of this stronger demand growth. Nevertheless, due to differences in network cost assumptions between the scenarios, there is still a broad range of <u>retail</u> price forecasts between the scenarios (

Chart A.7: Electricity: wholesale cost, NSW, index (2015=1)

Source: Frontier Economics

Appendix A Modelling methodologies   Final
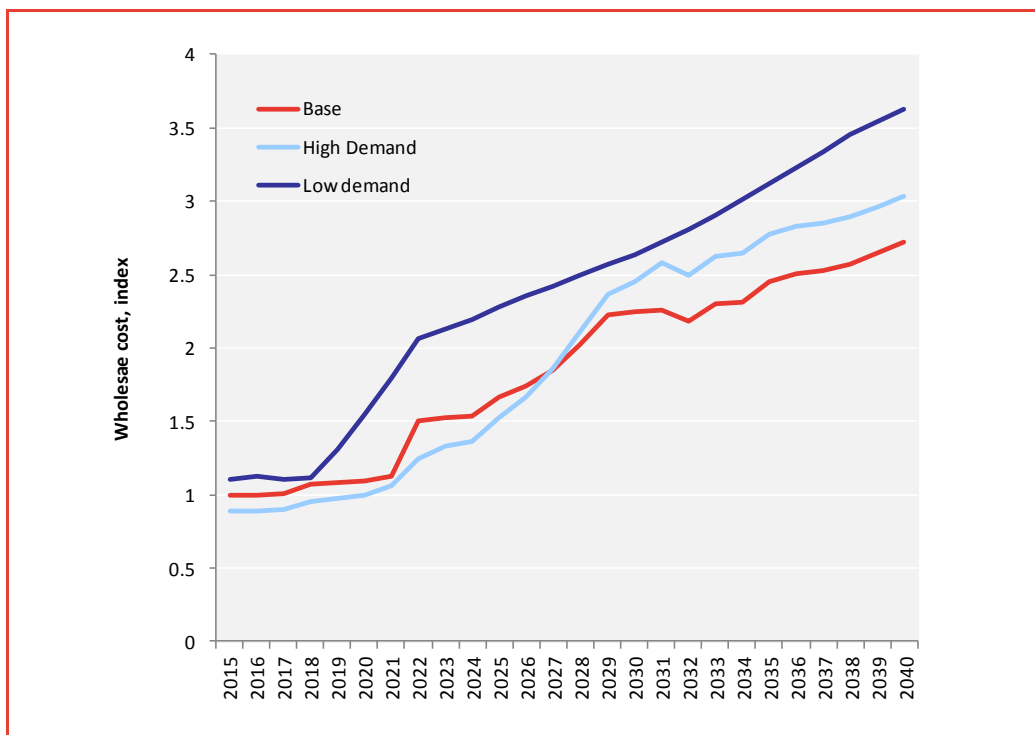
Chart A.7: Electricity: wholesale cost, Qld, index (2015=1)
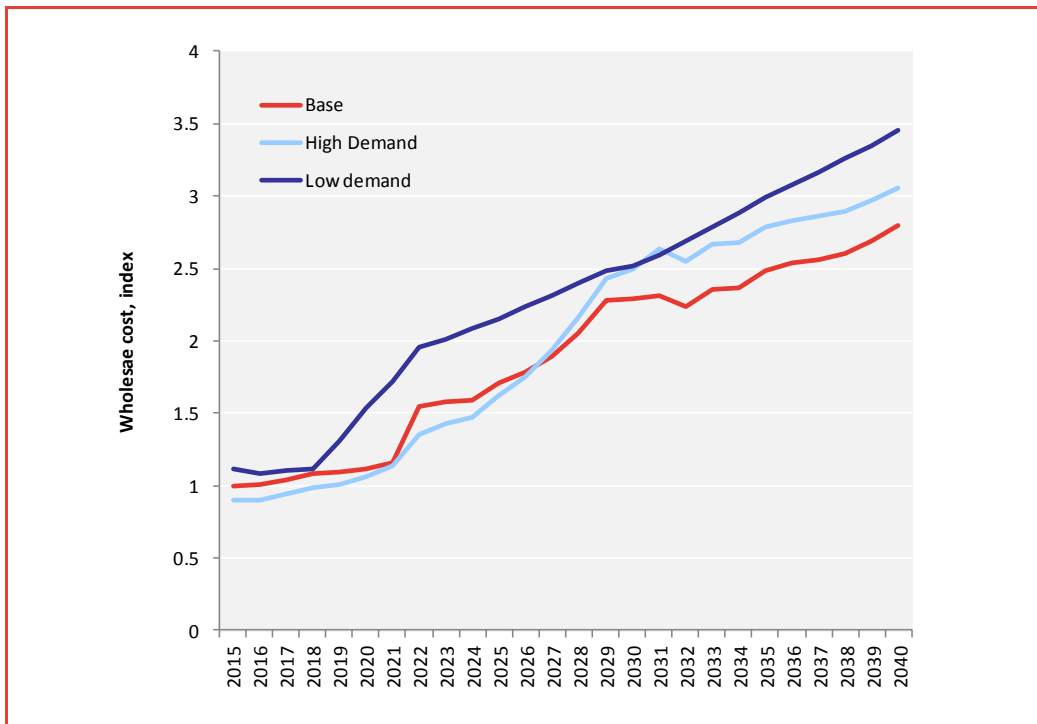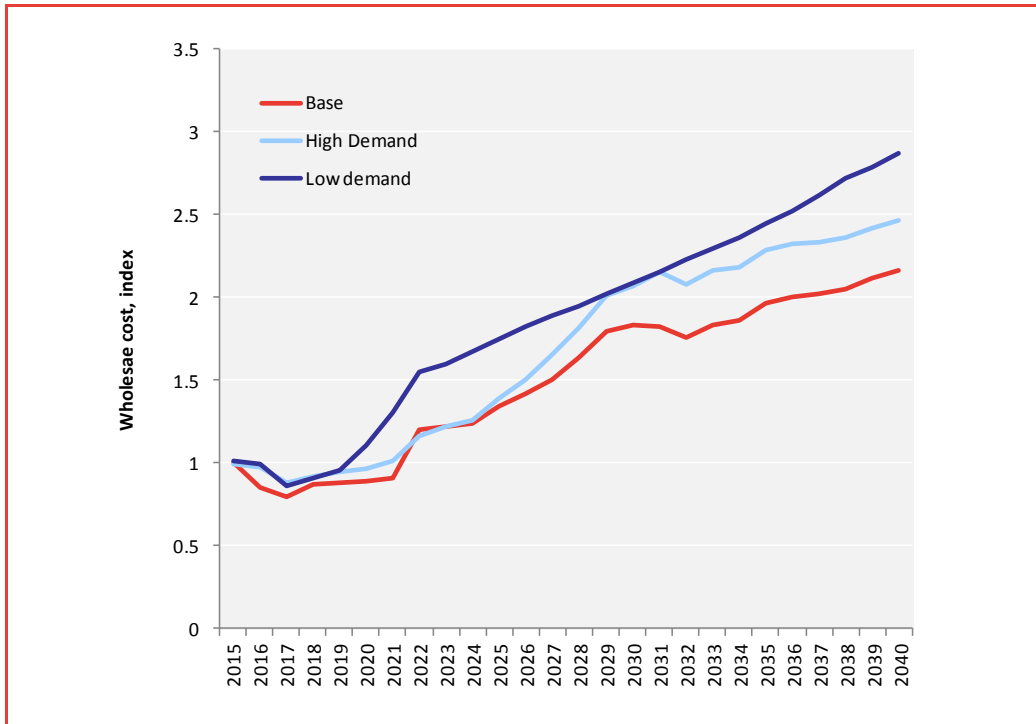

Source: Frontier Economics

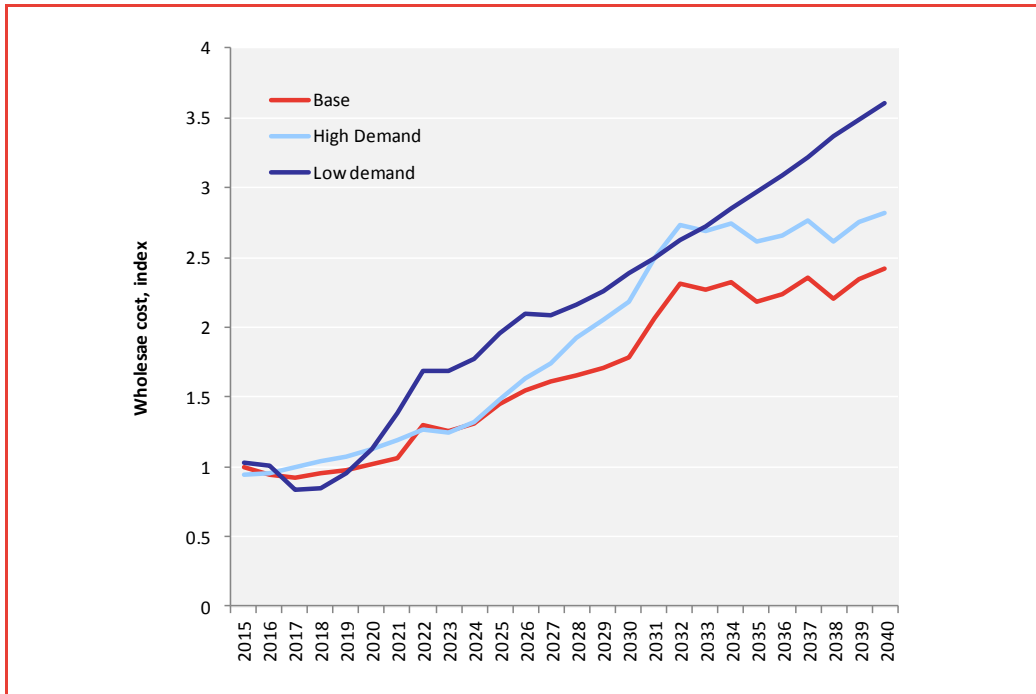Chart A.7: Electricity: wholesale cost, VIC, index (2015=1)
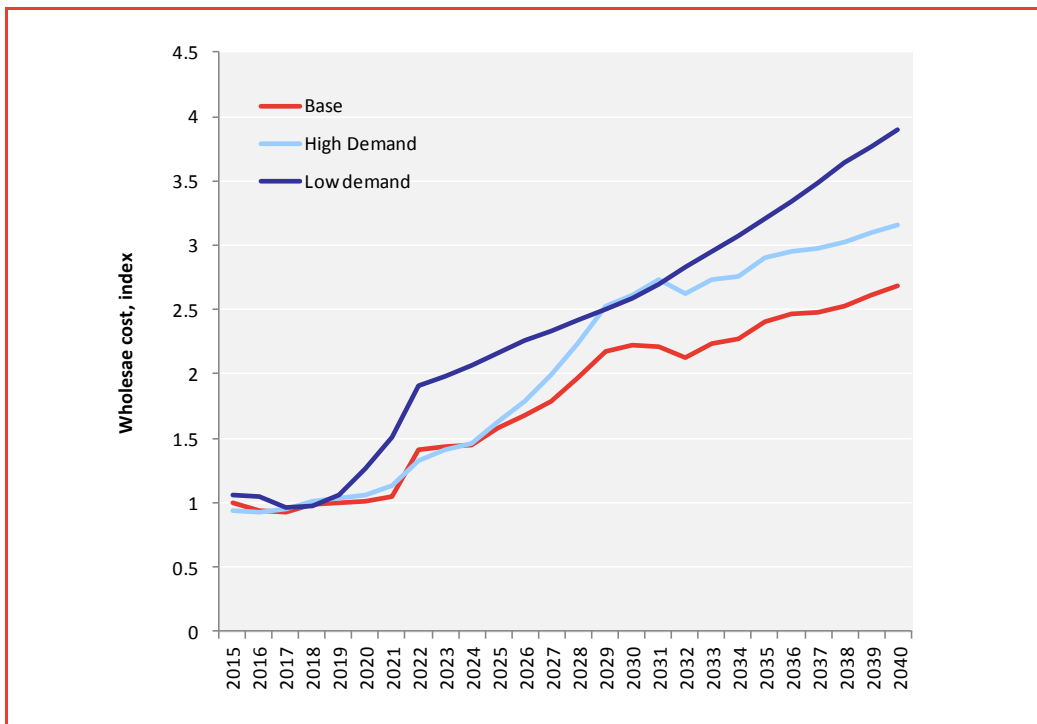
Source: Frontier Economics

Chart A.7: Electricity: wholesale cost, SA, index (2015=1)

Source: Frontier Economics

Chart A.7: Electricity: wholesale cost, Tas, index (2015=1)

Source: Frontier Economics

Appendix A Modelling methodologies   Final

TOTAL ELECTRICITY PRICES

AEMO also required a projected **total electricity price** estimate. Although this is a theoretical concept (no customer pays a **total electricity price**) this is calculated as a weighted average of residential and business electricity prices, where the weighting is consistent with the ESAA reported total electricity prices from 2003.