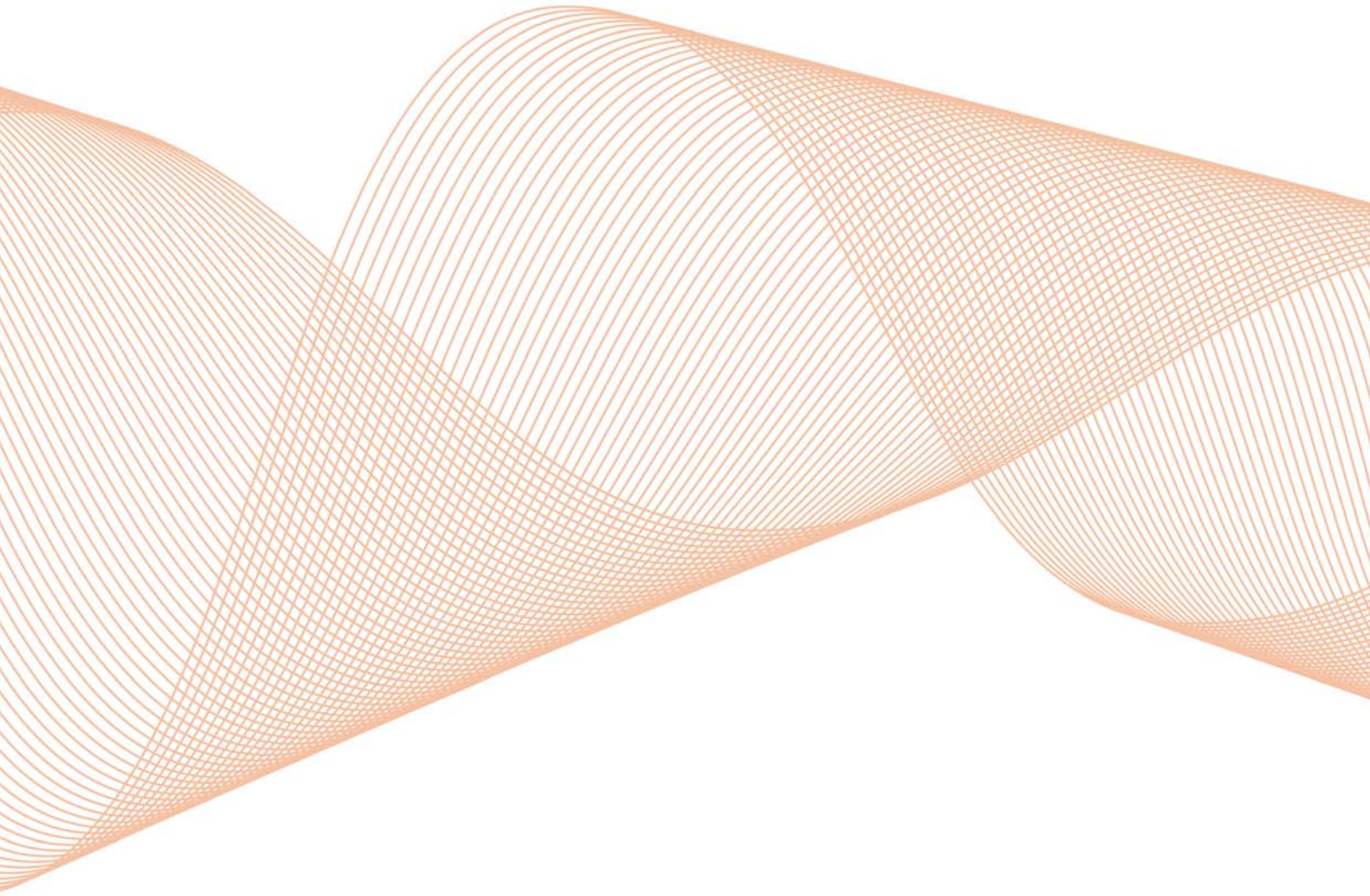
Appendix T – Deloitte Report – Energy and Customer Number Forecast for the AA3 Period

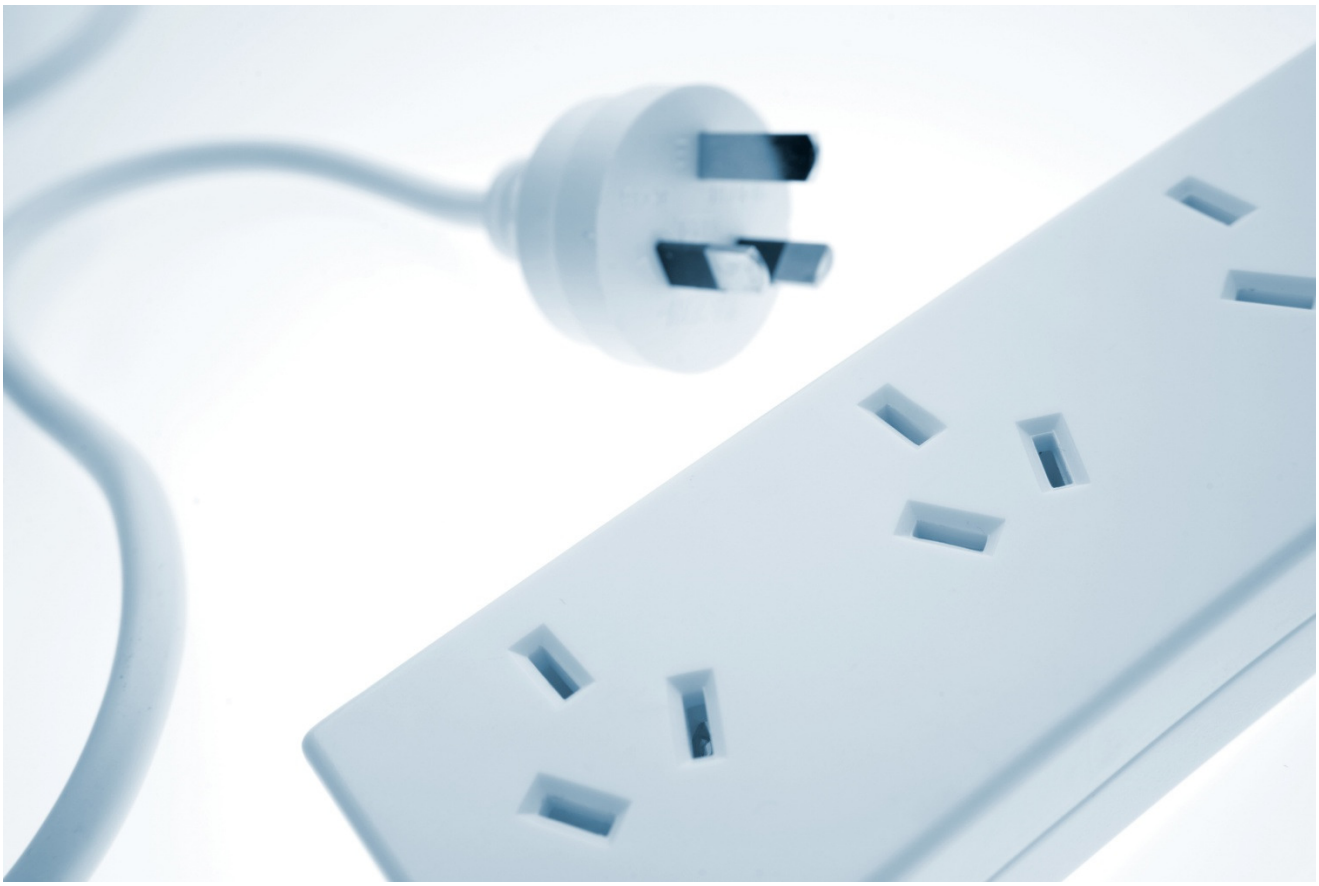
September 2011



Deloitte.

Western Power

Energy and customer number forecasts for the AA3 period (2012/13 to 2016/17)



18 August 2011

Version control

Date	Comment
4 February 2011	Original
7 February	Corrected table numbers
18 August 2011	Corrected information provided by Western Power with respect to transmission loads and the treatment of transmission losses

Contents

Statement of responsibility

This *Energy and customer number forecasts for the AA3 period (2012/13 to 2016/17*) (the "Report") was prepared for the Western Power solely for the purposes of informing Western Power decision making in regard to various components of its third Access Arrangement submission to the Economic Regulation Authority of Western Australia.

In preparing this *Report* we have relied on the accuracy and completeness of the information provided to us by Western Power and from publicly available sources. We have not audited or otherwise verified the accuracy or completeness of the information. We have not contemplated the requirements or circumstances of any one other than Western Power.

Events may have occurred since we prepared this *Report* which may impact on it and its conclusions.

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Executive summary

Scope of this paper

Deloitte has been engaged by Western Power to prepare energy and customer number forecasts for the electricity supply in the South West Interconnected Network (SWIN) for the next Access Arrangement period – 2012/13 to 2016/17 (AA3). The forecasts will be used to inform decision making in regard to various components of Western Power's third Access Arrangement submission. The results will need to be documented in a report that will withstand scrutiny by Western Power and the Economic Regulation Authority (ERA).

Specifically, Deloitte was asked to:

- *Develop and document the methodology to forecast transmission and distribution energy and customer number forecasts for the period 2012/13 to 2016/17. Describe all relevant inputs and report on their suitability and accuracy.*
- *Prepare the transmission and distribution energy and customer number forecasts for the period 2012/13 to 2016/17.*
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    1. *Independent Market Operator's Statement of Opportunities report.*
    2. *Growth rates related to Western Power's demand forecasts*

Data availability

Distribution level forecasts contained herein have been produced on the basis of our analysis of the historic information provided to us, being:

- four years of annual data on customer energy usage by customer group at the distribution level (2006/07 to 2009/10 financial years)
- five years of annual data on customer numbers by customer group at the distribution level (2005/06 to 2009/10 financial years).

Forecasts with respect to transmission connected loads and distribution connected block loads have been drawn from information provided by Western Power compiled on the basis of connection enquiries to Western Power. Information on transmission connected loads, transmission losses, unmetered distribution connected loads and distribution losses have been drawn from Western Power supplied data for the 2009/10 financial year.

Forecast results

Table 1: Forecast energy by customer group (GWh) – expected case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Residential	5,720	5,946	6,177	6,416	6,663	6,915	7,172
Small Business (<15 kVA)	867	900	926	951	976	1,003	1,031
General Business Small (15-100 kVA)	1,571	1,629	1,677	1,722	1,768	1,817	1,867
General Business Medium (100-300 kVA)	1,019	1,056	1,088	1,117	1,146	1,178	1,211
General Business Large (300-1000 kVA)	1,211	1,256	1,293	1,327	1,363	1,401	1,440
High Voltage < 1MVA	171	178	183	188	193	198	204
Customers >1MVA (high & low voltage)	3,347	3,457	3,512	3,525	3,545	3,567	3,592
Total distribution system[a]	***13,907***	***14,421***	***14,856***	***15,246***	***15,654***	***16,080***	***16,517***
Distribution system losses / streetlights / unmetered[b]	785	815	839	861	884	908	933
Sales to transmission connected customers[c]	2,812	3,580	3,721	3,887	3,887	3,887	3,887
Energy at sub-stations	*17,505*	*18,816*	*19,417*	*19,994*	*20,425*	*20,875*	*21,337*
Transmission system losses[b]	450	483	499	514	525	536	548
Sent-out energy	17,954	19,300	19,915	20,507	20,950	21,411	21,885

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 2: Forecast energy by customer group (% growth rate) – expected case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Residential	4.05%	3.95%	3.88%	3.87%	3.85%	3.78%	3.72%
Small Business (<15 kVA)	4.78%	3.81%	2.89%	2.70%	2.63%	2.77%	2.79%
General Business Small (15-100 kVA)	4.78%	3.69%	2.95%	2.68%	2.67%	2.77%	2.75%
General Business Medium (100-300 kVA)	4.78%	3.63%	3.03%	2.67%	2.60%	2.79%	2.80%
General Business Large (300-1000 kVA)	4.78%	3.72%	2.95%	2.63%	2.71%	2.79%	2.78%
High Voltage < 1MVA	4.78%	4.09%	2.81%	2.73%	2.66%	2.59%	3.03%
Customers >1MVA (high & low voltage)	1.29%	3.29%	1.59%	0.37%	0.57%	0.62%	0.70%
Total distribution system[a]	3.63%	3.70%	3.02%	2.62%	2.68%	2.72%	2.72%
Distribution system losses / streetlights / unmetered[b]	3.63%	3.70%	3.02%	2.62%	2.68%	2.72%	2.72%
Sales to transmission connected customers[c]	3.62%	27.32%	3.94%	4.45%	0.00%	0.00%	0.00%
Energy at sub-stations	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%
Transmission system losses[b]	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%
Sent-out energy	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 3: Forecast customer numbers by customer group – expected case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Residential	897,157	918,707	940,318	962,228	984,377	1,006,546	1,028,496
Small Business (<15 kVA)	88,084	91,807	94,994	98,007	101,138	104,475	107,906
General Business Small (15-100 kVA)	17,089	17,811	18,429	19,014	19,621	20,269	20,934
General Business Medium (100-300 kVA)	2,606	2,717	2,811	2,900	2,993	3,091	3,193
General Business Large (300-1000 kVA)	954	994	1,029	1,062	1,096	1,132	1,169
High Voltage < 1MVA	95	99	102	105	109	112	116
Customers >1MVA (high & low voltage)	445	455	459	461	464	467	470
Total distribution system	***1,006,430***	***1,032,589***	***1,058,143***	***1,083,776***	***1,109,797***	***1,136,093***	***1,162,284***

Table 4: Forecast customer numbers % growth rate by customer group – expected case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Residential	2.51%	2.40%	2.35%	2.33%	2.30%	2.25%	2.18%
Small Business (<15 kVA)	5.31%	4.23%	3.47%	3.17%	3.19%	3.30%	3.28%
General Business Small (15-100 kVA)	5.31%	4.22%	3.47%	3.17%	3.19%	3.30%	3.28%
General Business Medium (100-300 kVA)	5.31%	4.26%	3.46%	3.17%	3.21%	3.27%	3.30%
General Business Large (300-1000 kVA)	5.31%	4.19%	3.52%	3.21%	3.20%	3.28%	3.27%
High Voltage < 1MVA	5.31%	4.21%	3.03%	2.94%	3.81%	2.75%	3.57%
Customers >1MVA (high & low voltage)	2.06%	2.25%	0.88%	0.44%	0.65%	0.65%	0.64%
Total distribution system	2.81%	**2.60%**	**2.47%**	**2.42%**	**2.40%**	**2.37%**	**2.31%**

1 Introduction

1.1 Scope of this paper

Deloitte has been engaged by Western Power to prepare energy and customer number forecasts for the electricity supply in South West Interconnected Network (SWIN) for the next Access Arrangement period – 2012/13 to 2016/17 (AA3). The forecasts will be used to inform decision making in regard to various components of Western Power's third Access Arrangement submission. The results will need to be documented in a report that will withstand scrutiny by Western Power and the Economic Regulation Authority (ERA).

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1.2 Data availability

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1.3 Structure of this report

The remainder of this *Report* is structured as follows:

- Section 2 discusses the relevant regulatory principles
- Section 3 discusses the methodology that has been applied to the development of forecasts
- Section 4 discusses economic assumptions and scenario design that is applied to the forecasts

- Section 5 outlines, in graphical form, the forecasts produced
- Section 6 discusses the factors relevant to validation of the forecasts
- Section 7 provides some concluding observations.

2 Discussion of regulatory principles

2.1 Best practice forecasting

Under sections 4.1 and 4.48 of the *Electricity Networks Access Code 2004* (the Code), Western Power, as a service provider of a covered network, must when submitting any proposed access arrangement, or proposed revisions to an access arrangement to the ERA, also submit access arrangement information. According to section 4.3 of the Code, the access arrangement information must include:

> *(a) information detailing and supporting the price control in the access arrangement*
>
> *(b) information detailing and supporting the pricing methods in the access arrangement*
>
> *(c) if applicable, information detailing and supporting the measurement of the components of approved total costs in the access arrangement*
>
> *(d) information detailing and supporting the service provider's system capacity and volume assumptions.*

The ERA has published guidelines[1] setting out in further detail what information must be included in access arrangement information in order for the information to comply with the Code. However, these guidelines concentrate on the reporting of financial (quantitative) information and do not go into the specifics of what needs to be included with respect to energy or customer number forecasts or the principles by which these forecasts should be determined.

The principles of good practice forecasting should apply across a range of industries. Relevant principles have been most clearly articulated in the context of regulation of the water industry by the Essential Services Commission of Victoria that expressed a view[2] that any methodology used to prepare forecasts should:

- be applied in an unbiased manner (that is due weight must be given to all the relevant factors)
- be appropriate to the situation and the nature of the market for services
- recognise and reflect key drivers of demand
- be based on reasonable assumptions using the best available information
- be assessed against any other existing forecasts and methodologies
- use the most recent data available, as well as historic data that can identify trends in demand

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[1] Economic Regulation Authority Western Australia, 2008, *Electricity Networks Access Code 2004 – Guidelines for Access Arrangement Information*, 26 June. Available at: http://www.erawa.com.au/cproot/6682/2/20080626%20Electricity%20Networks%20Access%20Code%202004%20-%20Guidelines%20for%20Access%20Arrangement%20Information.pdf

[2] See Essential Services Commission, *Discussion Paper: Economic Regulation of the Victorian Water Sector, Demand Forecasting*, undated. Available at: http://www.esc.vic.gov.au/NR/rdonlyres/71174636-8EA1-452B-AFED-70C5BDD22BB8/0/DemandForcastingDiscussionPaper04.pdf

- take account of current demand and economic conditions, and reasonable prospects for future market development

In addition to these principles, good practice forecasting for regulatory purposes should take account of the need for repeatability. Where reliance on externally sourced data is necessary, such data should be obtained from well established data sources that are likely to continue to produce similar data in a consistent manner.

2.2 Revenue caps versus price caps

In considering the form of price control for the AA3 period, it is understood that Western Power contemplated a weighted average price cap for the distribution business. Having assessed the information needs of a weighted average price cap, it is understood that Western Power is now proposing a revenue cap for the AA3 period due to uncertainty around achievable levels of accuracy for energy and customer number forecasts at a detailed level.

This document develops a methodology that Western Power could apply into the future that, subject to sufficient confidence in the accuracy of the forecasts, may support Western Power proposing a weighted average price cap for future Access Arrangement submissions.

2.2.1 How they work

- Revenue caps
  - Revenue cap set for each year by a regulator that establishes the amount of revenue allowed to be recovered by the network business to fulfil its obligations with respect to network development and maintenance
  - Regulated network operator is given (some) flexibility to establish tariffs based on energy and customer number forecasts designed to recover allowable revenue
  - True-up provisions will allow the regulated network operator to change tariffs (within the flexibility it is given) to adjust revenue recovery from year-to-year up or down as required.
- Price caps
  - Regulator establishes a ‘fair price’ for each service (or basket of services) taking account of:
    - : the revenue required by the network business to fulfil its obligations with respect to network development and maintenance
    - : the regulated network operator’s forecasts of energy throughput and customer numbers
  - Regulator will impose restrictions on the extent to which (basket) prices can change.

2.2.2 The need for accurate forecasts

Western Power’s revenue earned under a revenue cap is subject to the k-factor. The k-factor adjusts the current year’s revenue cap due to any difference between the revenue received in the previous year and the previous year’s revenue cap. In this case, energy and customer number forecasts are not part of the regulatory contract. If actual energy usage and customer numbers vary from forecasts, the k-factor results in the higher/lower revenue being returned/recouped to/from customers.

Under a price cap form of price control, energy and customer number forecasts are effectively part of the regulatory contract. Variations in energy use or customer numbers

compared to forecasts result in corresponding variation to revenue for the regulated network operator.

In summary, inaccurate forecasts have greater consequences for a regulated network operator under a price cap regime. Hence, there is a greater need for energy and customer number forecasts to be more accurate under a price cap regime.

In addition, under a price cap regime, it is necessary to forecast demand for different tariff classes in order to determine the "x" factor in the CPI – x type formulae. This is not necessarily the case under a revenue cap.

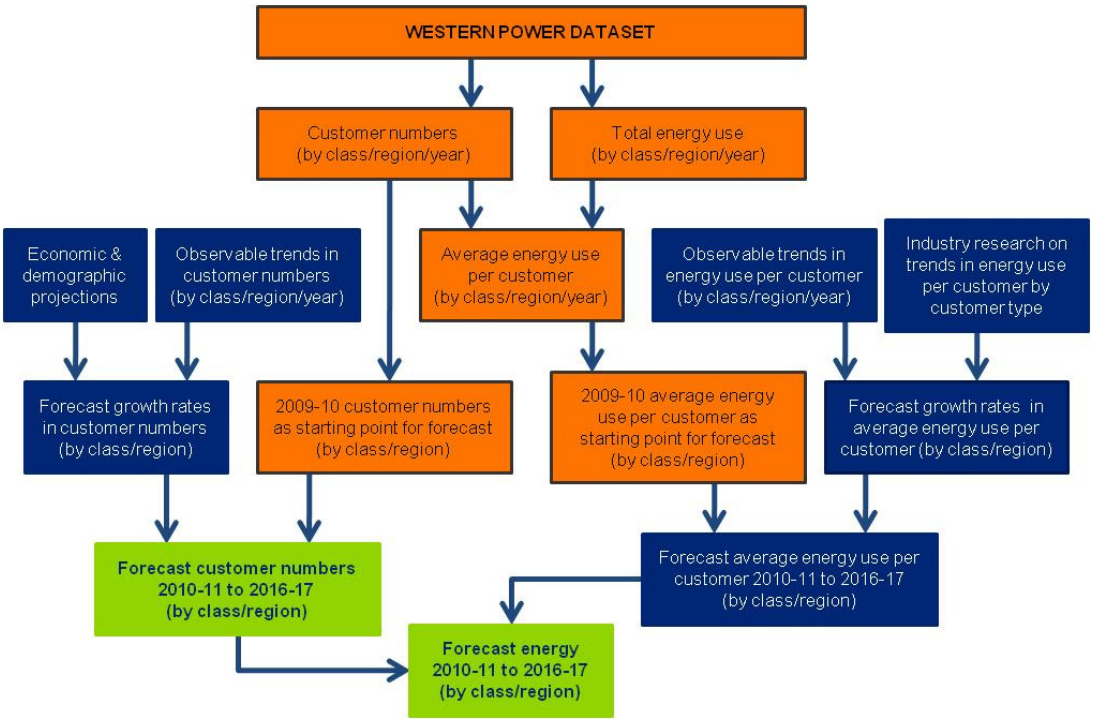
Given that Western Power has expressed an intention to transition to a price cap regime in a future regulatory period, the methodology described herein represents a step towards the necessary tools to support such a move.

3 Methodology

3.1 Methodology overview

The methodology we have used to build forecasts of energy and customer numbers is schematically described in Figure 1. The orange boxes in Figure 1 represent information extracted directly from the datasets provided by Western Power. The dark blue boxes represent data obtained from other sources. The green boxes represent the results that are the objective of this engagement. Key elements of the detail of how this methodology is applied to each group of customers is described in the remainder of this section.

Figure 1: Schematic of forecasting methodology



Although historically observed trends can provide valuable insights into changing behaviours, greatest value is drawn from historical observations where there is a reasonable time series of complementary data sets from which correlations between data series can be analysed – noting that statistical correlation alone is not proof of a relationship. Suggestions for ways in which baseline information could be better prepared for use in this methodology are contained in *Appendix A: Opportunities to improve forecast information*.

3.2 Reporting categories

Western Power provided annual energy and customer number figures for each of the categories listed in column 1 (Customer group and tariff) of Table 5.

Table 5: Aggregation categories for customers

Customer group - tariff[3]	Customer group	Level 3 aggregation	Level 4 aggregation
General Business Large (300-1000 kVA) - RT2	General Business Large (300-1000 kVA)	Business 15kVA- 1MVA	All distribution connected load
General Business Large (300-1000 kVA) - RT6			
General Business Large (300-1000 kVA) - RT4			
General Business Medium (100-300 kVA) - RT2	General Business Medium (100-300 kVA)		
General Business Medium (100-300 kVA) - RT6			
General Business Medium (100-300 kVA) - RT4			
General Business Small (15-100 kVA) - RT2	General Business Small (15-100 kVA)		
General Business Small (15-100 kVA) - RT6			
General Business Small (15-100 kVA) - RT4			
High Voltage < 1MVA - RT11	High Voltage < 1MVA		
High Voltage < 1MVA - RT5			
High Voltage > 1MVA - RT7	High Voltage > 1MVA	Business > 1MVA	
High Voltage > 1MVA - RT5			
Low Voltage > 1MVA - RT2	Low Voltage > 1MVA		
Low Voltage > 1MVA - RT8			
Low Voltage > 1MVA - RT6			
Low Voltage > 1MVA - RT4			
Residential - RT1	Residential	Residential and small business	
Residential - RT3			
Small Business (<15 kVA) - RT2	Small Business (<15 kVA)		
Small Business (<15 kVA) - RT11			
Small Business (<15 kVA) – RT6			
Small Business (<15 kVA) - RT4			

In our view, forecasting energy and customer number figures at this level would require pursuing a level of accuracy that is not achievable. Forecasts have therefore been produced at the level indicated in column 2 (Customer group) of Table 5, with subsequent reported aggregations to Levels 3 and 4 as indicated in Table 5. With forecasts at this level, Western Power can use its knowledge of connection policy and detailed experience of customer connection choices to allocate the Customer Group forecasts to individual tariff classes.

[3] For an explanation of tariff codes see *Appendix D: Glossary of tariff codes*.

The data provided by Western Power was also disaggregated at the region level (see Table 6 for the list of regions). The purpose of seeking disaggregation at this level was to assess the potential for forecasting by region. However, given the volatility of the data presented at the regional level, detailed sub-SWIN forecasting was only viable for residential customers – and then only at the "Perth" and "non-Perth SWIN" level.

Table 6: Aggregation categories for customers

Level A	Level B	Level C
Kalgoorlie	Non-Perth SWIN	SWIN
North Country		
South Country		
North Metro	Perth	
South Metro		

3.3 Application of methodology to residential customers

3.3.1 Demographic projections & observed trends in household numbers

Growth in residential customer connections and growth in household numbers is reasonably closely correlated (see Table 7), albeit that the number of residential sites connected (as recorded by Western Power) is growing slightly faster than household numbers projected by the Australian Bureau of Statistics (ABS).[4]

Table 7: Growth in residential connections and ABS estimates of household growth

	2006/07	2007/08	2009/09	2009/10
Perth				
Western Power residential connections	2.75%	2.67%	2.68%	2.72%
ABS household number projections	2.59%	2.57%	2.56%	2.57%
Non-Perth SWIN				
Western Power residential connections	2.92%	3.07%	2.68%	2.51%
ABS household number projections	2.74%	2.81%	2.66%	2.45%

[4] For 2005-06 the number of residential sites connected (639,862) as recorded by Western Power is around 11% higher than the number of households (578,252) as estimated by the ABS for Perth. There is also a discrepancy between similar statistics in other states. The reasons for this discrepancy are not readily apparent, although a high correlation in the growth rates makes logical sense.

Projected growth rates for residential customer numbers will be based on published projections for household numbers produced by the ABS – the ABS publishes projections of household numbers extending from 2006 to 2031.[5] These projections are broken down into:

- Whole of Western Australia
- Perth
- Rest of Western Australia.

Therefore, the data facilitate some level of matching against observed residential site numbers from Western Power's data sets. Given that the Western Power residential customer numbers have been growing at a rate very close to the ABS estimate, but consistently slightly above (in the order of 0.1 percentage points), the high case scenario will incorporate a premium of 0.1 percentage points above the ABS estimate of growth. ABS Series II will be used for the expected case and ABS Series III (with a 0.1 percentage point premium) will be used for the high case.

The ABS projections of household numbers are a preferred tool over alternatives such as information on land development (e.g. lots clearance and lots in services) because of the robustness and national consistency of the methodologies used by the ABS to develop its projections. The ABS projections are publicly released and also produced on a regular basis, making them ideal as a basis of forecasting that is likely to have to be replicated at some future time.

ABS projections for household formation are reported for "Perth" and "balance of Western Australia":

- Mapping of demographic data confirms a strong correlation between Western Power "Perth" (South Metro and North Metro) regions and ABS "Perth" boundaries. Accordingly, the implied growth rates from the ABS household number projections for "Perth" has been applied to residential customer numbers as recorded by Western Power for the Perth,
- Over 60% of non-Perth households in Western Australia are located within the SWIN.[6] Accordingly, the implied growth rates from the ABS household number projections for "rest of Western Australia" will be applied to residential customer numbers as recorded by Western Power for the non-Perth SWIN.[7]

The actual growth forecasts used in the forecasting of household numbers are detailed in Section 4.4.

3.3.2 Energy use per household

Deloitte has been unable to identify any consistently published reputable source of estimates of projected changes in energy use per household.

Rather than relying on a single source of published information for indicators of how energy use per household is likely to change, observed historical trends in energy use per

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[5] ABS Cat No. 3236.0, *Household and Family Projections, Australia 2006 to 2031* (released 6 June 2010). Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/0AAC8BFAE9DD3241CA2568A90013942A?opendocument

[6] Based on Deloitte estimates of non-Perth SWIN household numbers and ABS estimates of non-Perth Western Australia household numbers.

[7] We acknowledge the possibility that the rate of household formation in the non-Perth SWIN may not match the rate of household formation on non-Perth WA. However, we are not aware of comprehensive data sets or consistently based projections that could be used to support any alternative assumption.

household from Western Power datasets are valuable in providing insights into the rate at which energy use may change. Other factors that will need to be taken into account when developing projections of growth in energy use per household include:

- Household propensity to acquire additional (or more) energy intensive devices – e.g. more or bigger air-conditioning units; flat screen TVs; convenience devices that require regular charging such as portable computers, mobile phones etc.
- Adoption of more energy efficient devices and appliances – e.g. refrigeration (food storage), lighting, heating and air-conditioning
- Adoption of solar hot water systems, rooftop photo-voltaic systems or other forms of micro-generation
- The extent of pressure on urban boundaries and the impact of this pressure on the size of the average home
- Development of demand management programs
- Take-up of electric vehicles.

Data supplied by Western Power reveals an average annual change of close to 2% in energy use per household across the SWIN in the four years to 2009/10 (see Table 8).

Table 8: Growth in average energy use per household

	2006/07	2007/08	2009/09	2009/10
Perth	1.7%	3.1%	1.6%	2.7%
Non-Perth SWIN	1.3%	2.8%	2.2%	1.0%

In contrast to this most recent evidence we note that the Environmental Protection Authority (EPA) in Western Australia has undertaken some research in this area and has reported:

> *Since 1990, per capita residential energy use has grown about 11%, from 15.5 gigajoules per capita in 1990 to 17.2 gigajoules per capita in 2005 ... The rate of growth in per capita residential energy consumption has slowed considerably since the mid-1990s and has even declined slightly since 2003.*[8]

However, the EPA is not specific as to the extent of the decline. Other Western Australia specific material tends to discuss in general terms:

- Drivers of changes in population trends[9]
- Contributions to total energy use from specific appliances[10,11].

Published material for Victoria and South Australia in relation to energy usage per household does not indicate a clear trend either up or down. [12] Other industry sources advise that, energy use per household in both New South Wales and Queensland has been declining

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[8] Environmental Protection Authority (WA), *State of the environment report, Western Australia*, 2007.

[9] Western Australia Planning Commission, *Western Australia Tomorrow Population Report No. 6*, November 2005.

[10] Department of the Environment, Water, Heritage and the Arts (C/w), *Energy Use in the Australian Residential Sector 1986-2020*, 2008.

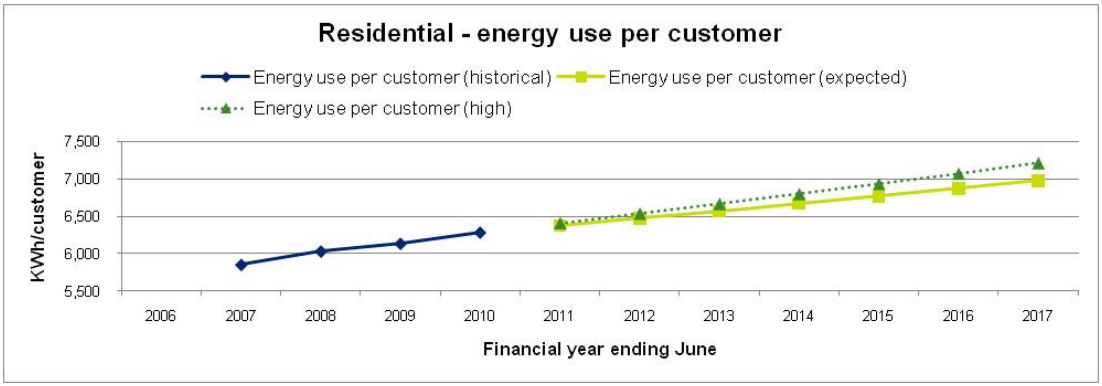
[11] Office of Energy (WA), *The impact of residential air-conditioning on the Western Australian electricity system*, Information paper, December 2004.

[12] See ESCOSA, *Annual Performance Report South Australia Electricity Supply Industry*, 2009-10; ACIL Tasman (for the Australian Energy Regulator) *Victorian Electricity Distribution Price Review, Review of electricity sales and customer numbers forecasts, Final report*, April 2010.

over the past 4 years, following an extended period when energy use per household had been rising.[13] A likely explanation for this difference in residential energy usage trends is that new household formation in Western Australia tends to be of the stand alone dwelling variety, whereas in New South Wales and Victoria there is a more pronounced trend towards smaller dwellings such as units or flats as a result of urban consolidation and pressure on urban boundaries.[14]

We acknowledge the range of influences driving household energy use both up and down, but find the most recent (consistent) evidence from the Western Power data hard to discount. In the absence of anything to suggest that the trend within the SWIN is likely to change within the next few years, we believe that future growth in energy consumption per household will be in the range of 1.5% to 2.0% per annum – see Figure 2.

Figure 2: Historical and forecast growth rates



3.4 Application of methodology to general business customers

3.4.1 Projections of business numbers

Ideally, the number of sites in each business customer group identified in Table 5 could be correlated to known and consistently measured economic aggregates such as gross state product (GSP), state final demand (SFD) or indices of business formation. However, in trying to develop correlations that may be useful in forecasting, the following factors should be borne in mind:

- Western Power has provided 5 years of customer data which is not enough to establish a reliable trend line in the rate of business site growth
- There is no known lengthy time series of consistently measured business numbers in Australia. Since 2003, the ABS has released three versions of its counts of Australian

[13] There is very little public domain material that reports on trends in energy use per customer – Western Power has supplied information that allows examination of growth rates over the past four years, For longer time series on general household behaviours we are dependent on reports such as Parliament of New South Wales, Public Works Committee, *Inquiry into energy consumption in residential buildings*, March 2004. The Public Works Committee indicated that in New South Wales, long term trends of growth in energy use per household had been around 1.5% per annum.

[14] ABS census data supports this conclusion.

businesses,[15] covering the period from June 2003 to Jun 2009. However, with respect to the most recent release (covering the period June 2007 to June 2009) the ABS notes:

> *There have been some changes to this publication compared with the previous release. As such, the counts presented in this publication are not comparable with those presented in previous releases.*[16]

- Given the recent mining boom and the relatively rapid expansion of the Western Australian economy outside the SWIN boundaries, it is highly likely that economic growth outside the SWIN boundary is higher than economic growth inside the SWIN boundary. Hence, changes in GSP and SFD for Western Australia are not necessarily good indicators of economic growth within the SWIN boundary and, therefore, the rates of change in the number of general business sites is likely to have diverged to the extent that long term correlations cannot be reliably established.

Nevertheless, Deloitte believes that (discounted) GSP growth is likely to offer the best indicator of business growth. Using the available data, over the five years to the 2009/10 FY, the number of businesses with connections between 15kVA and 1000kVA has grown at an annual average rate of 4.05%, with GSP growth over the same period of 4.26%. Acknowledging the small sample of observations, it is plausible that the rate of growth in business customer numbers (including small business (<15kVA)) will be somewhere between 90% and 100% of the rate of growth in GSP – 90% pass through and 100% pass through will be reflected in the expected and high case scenarios respectively.

3.4.2 Energy use per business user

Although there are few reputable sources of information on likely future energy use per business user, we have been able to derive some useful insights based on information from Australian Government organisations – for example, the Australian Bureau of Agricultural and Resource Economics (ABARE) notes:

> *There has been a long-term decline in the energy intensity (energy consumption per unit of GDP) of the Australian economy. This trend can be attributed to two main factors. First, greater efficiency has been achieved through both technological improvement and fuel switching. Second, rapid growth has occurred in less energy intensive sectors such as the commercial and services sector relative to the more moderate growth of the energy intensive manufacturing sector. Trends in energy intensity are not uniform across Australia. For example, in recent years the growing resources sectors of Western Australia and Queensland have led to energy intensity being higher in these states than in Victoria and New South Wales, where the services sectors have grown strongly.*[17]

ABARE defines "energy intensity" in this context as: "energy consumption per unit of GDP of the Australian economy". Deloitte is of the view that the increasing energy intensity in Western Australia and Queensland is attributable to the resources boom, which in Western Australia is happening largely outside the SWIN. Victoria and New South Wales (with more stable industry mix compared with Western Australia and Queensland) have experienced a decline in energy consumption per unit of GSP, an outcome that is entirely consistent with declining energy use per average user. The over-arching proposition adopted within this report is that energy use per unit of GDP for non-resources intensive sectors will decline.

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[15] ABS Cat. No. 8165.0, *Counts of Australian Businesses, including Entries and Exits*. Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202007%20to%20Jun%202009?OpenDocument

[16] ABS Cat. No. 8165.0, *Counts of Australian Businesses, including Entries and Exit*, June 2003 to Jun 2009, p2.

[17] ABARE, Energy in Australia 2010, pp11-12. Available from: http://www.abare.gov.au/publications_html/energy/energy_10/energyAUS2010.pdf

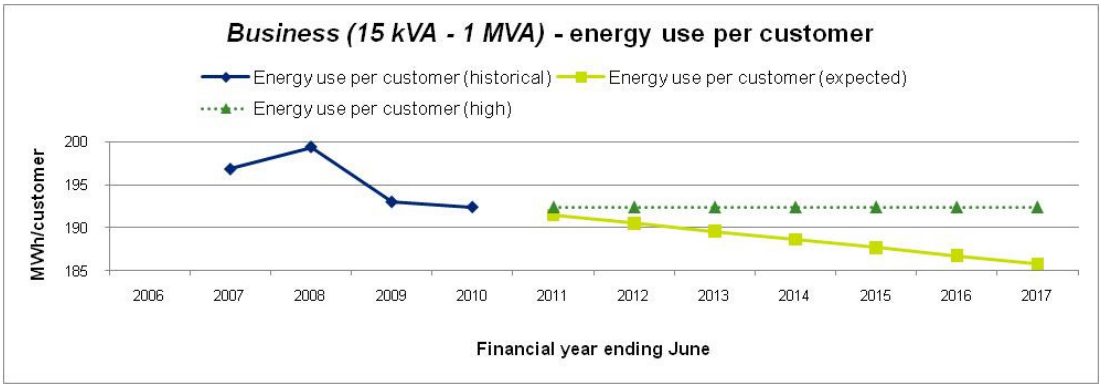
Available, and relatively consistently measured, indicators of trends in average energy use for non-residential customers are presented in Table 9.

Table 9: Trend growth in average energy use for non-residential distribution customers

	Slope of line of best fit
SWIN Business (15kVA to 1MVA) 2006/07 to 2009/10	-1.0%
SWIN All business >15kVA (incl "block loads") 2006/07 to 2009/10	-3.6%
SWIN All non-residential 2006/07 to 2009/10	0.0%
South Australia All non-residential 2005/06 to 2009/10	1.0%
Victoria All non-residential 2005/06 to 2009/10	0.4

As with households, observed trends in energy use per business in each category will be valuable in providing insights into the rate at which energy use is changing. Figure 3 depicts the historic and projected growth rates applicable to general business customers with a connection size between 15kVA and 1MVA – for the expected case energy use per customer is assumed to decline at the rate of 0.5% per annum, and in the high case energy use per customer is assumed to remain unchanged year to year.

Figure 3: Historical and forecast growth rates



This expected case change in average use per customer of -0.5% has also been applied to the small business (<15kVA) load. While the average use per customer has recently fallen by more than this (around 4-5% per annum reductions over the past three years), falls are unlikely to continue at this rate.

3.5 Application of methodology to very large customers

The following groups of very large customers will not be subject to the application of the generic forecasting methodology for connection numbers and energy usage:

- Low voltage customers with connections greater than 1MVA
- High voltage customers with connections greater than 1MVA
- Transmission connected customers.

Given the lumpy nature of investment in such facilities, forecasts of new connections and disconnections of these customers cannot be based on historic trends and projections of economic growth with an acceptable degree of accuracy. Connections at this level will be heavily influenced by business responses to government policies and business responses to one-off factors around interstate and international trading opportunities. The best information available as to the likely connection / disconnection rates of these customers is from connection inquiries managed by Western Power.

Deloitte has been provided with information relating to relevant connection inquiries and this information, together with knowledge of existing customer numbers and energy usage, will be used to develop forecasts relating to the 'very large' electricity users. However, in applying this information we note the following:

- The information has been collected with a focus on measuring system peak loading effects and not on assessing energy requirements – Deloitte has been advised by Western Power that to estimate the annual energy requirements from identified block loads:
  - For distribution connected loads, a load factor of 53% should be assumed[18]
  - For transmission connected loads, a load factor of 70% should be assumed.
- Not all likely new loads are necessarily captured in the information provided with respect to future connections. As advised by Western Power:[19]

  > *For a project to be identified as a new block load it is necessary that the proposed projects have a load demand that exceeds the underlying annual trend growth (in MW) as seen at the appropriate substation. Moreover, after consultations with relevant stakeholders Western Power requires that a reasonable probability exists to justify the addition of the new block load in the load forecast. The probability of including a forecast is determined based on the 'combination rating' of a number of conditions such as when load is required, progress to connection, augmentation that may be required, and load compared to underlying load factors. The probability determines whether this block load is applied to either the central or high forecast. The central forecast includes those loads in the low forecast plus loads with a high likelihood of proceeding. The high forecast includes those loads in the central forecast plus a number of loads with lesser likelihood of proceeding.*

The information provided on expected MVA connections and the implied energy output (given assumed load factors) is summarised in Table 10.

[18] Email from Sevi Rich (Western Power) to Stuart James (Deloitte), dated 20/9/10.

[19] Email from Josephine Nga (Western Power) to Stuart James (Deloitte), dated 26/11/10.

Table 10: Block load connections and implied energy output from forecast block loads

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Distribution loads							
MVA connected (cumulative)							
Expected forecast	9	33	45	48	52	57	62
High forecast	31	53	83	92	102	119	131
GWh (cumulative)							
Expected forecast	43	152	207	221	240	262	288
High forecast	145	248	384	426	475	551	609
Transmission loads							
MVA connected (cumulative)							
Expected forecast	16	141	164	191	191	191	191
High forecast	31	142	195	378	623	680	768
GWh (cumulative)							
Expected forecast	98	866	1,007	1,173	1,173	1,173	1,173
High forecast	190	872	1,195	2,320	3,820	4,171	4,711

4 Economic assumptions and scenario design

This section discusses some of the economic policy and behavioural factors as well as sources of economic information that will affect the production of forecasts of energy and customer numbers.

4.1 Climate change and carbon policies

Consistent with the methodology understood to be applied by Western Power in the development of its maximum demand forecasts, Deloitte will assume that:

- There is no policy induced carbon price that will affect the wholesale and retail price of electricity
- There is no long term climatic change that will affect the demand for electricity.

4.2 Elasticity of demand

There has been ongoing policy debate in Western Australia over how quickly retail prices for electricity would be adjusted to cost-reflective levels. It is understood that there have been substantial changes in electricity prices over the past two years, but the extent of further adjustment to prices is subject to uncertainty.

The potential for further movement towards cost-reflective prices is relevant to forecasts of energy use because of the price elasticity of demand and the prospect of electricity consumers changing usage patterns as a short term response to price rises. Arguably, given the recent price rises it is probable that consumption behaviours constrained by their current set of appliances have already changed as much as is practicably achievable in the short term.

Therefore, under the existing circumstances, there is no solid rationale to apply existing estimates of the price elasticity of demand for electricity as a mechanism for adjusting energy consumption forecasts. We will thus assume zero change to electricity consumption in the short term due to future unit price changes alone. Future changes to electricity consumption behaviour will be driven by medium and longer term changes to the set of electrical appliances held by consumers rather than further changes in the patterns of usage in existing electrical appliances.

4.3 Growth in gross state product

Forecasts of GSP growth for Western Australia underlying the results in this report for "expected case" scenarios were taken from the most recent available forecasts produced by Access Economics at the time the report was prepared in late 2010.[20] As part of a sensitivity analysis, Deloitte has also prepared "high case" forecasts and will be using the higher of the

[20] Access Economics, *Access Economics' Business Outlook*, September quarter 2010, p110.

Access Economics forecasts and the most recently available of IMO's own "high case" GSP forecasts.

4.4 Scenario design

In developing forecasts, Deloitte has designed both "expected case" and "high case" economic assumptions as outlined in Table 11 and Table 12 consistent with the discussion in Section 3.

In the expected case scenario, the SWIN business customer number growth rate is expressed as a uniform 90% of the GSP growth rate. In the high case, GSP growth has a 100% flow through to assumed business customer number growth.

Table 11: Economic assumptions (expected case scenario) – estimated growth rates

	Economic and overall system growth		Household growth rate[21]		Energy use per unit	
FY ending June	**GSP for WA**	**SWIN business customers**	**Perth**	**Non-Perth SWIN**	**H'holds**	**General business**
2011	5.90%	5.31%	2.54%	2.39%	1.50%	-0.50%
2012	4.70%	4.23%	2.44%	2.23%	1.50%	-0.50%
2013	3.86%	3.47%	2.39%	2.17%	1.50%	-0.50%
2014	3.52%	3.17%	2.38%	2.11%	1.50%	-0.50%
2015	3.55%	3.19%	2.36%	2.06%	1.50%	-0.50%
2016	3.67%	3.30%	2.31%	1.99%	1.50%	-0.50%
2017	3.65%	3.28%	2.25%	1.89%	1.50%	-0.50%

[21] Growth rates from projected household numbers in ABS Cat No. 3236.0, *Household and Family Projections, Australia 2006 to 2031*, Tables 1.15 and 1.16 (released 6 June 2010), Series II.

Table 12: Economic assumptions (high case scenario) – estimated growth rates

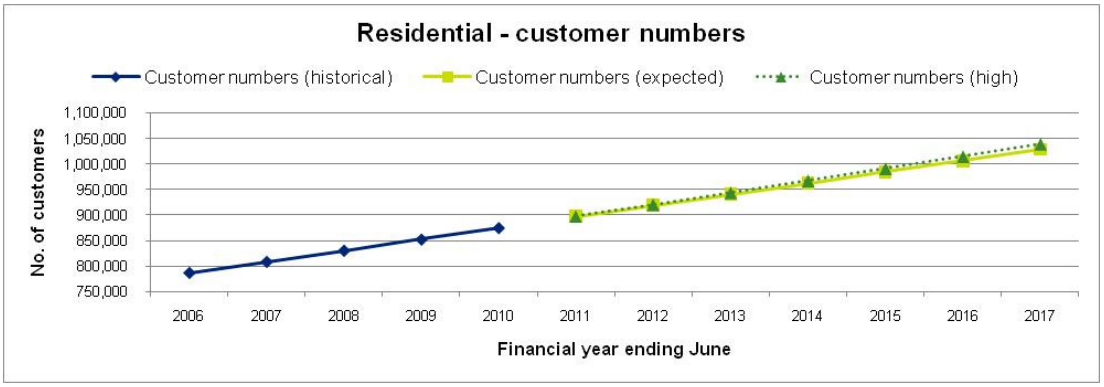
	Economic and overall system growth		Household growth rate[22]		Energy use per unit	
FY ending June	**GSP for WA**	**SWIN business customers**	**Perth**	**Non-Perth SWIN**	**H'holds**	**General business**
2011	5.90%	5.90%	2.64%	2.49%	2.00%	0.00%
2012	6.70%	6.70%	2.60%	2.40%	2.00%	0.00%
2013	5.90%	5.90%	2.55%	2.34%	2.00%	0.00%
2014	4.10%	4.10%	2.53%	2.28%	2.00%	0.00%
2015	5.40%	5.40%	2.51%	2.22%	2.00%	0.00%
2016	5.10%	5.10%	2.46%	2.16%	2.00%	0.00%
2017	6.30%	6.30%	2.42%	2.09%	2.00%	0.00%

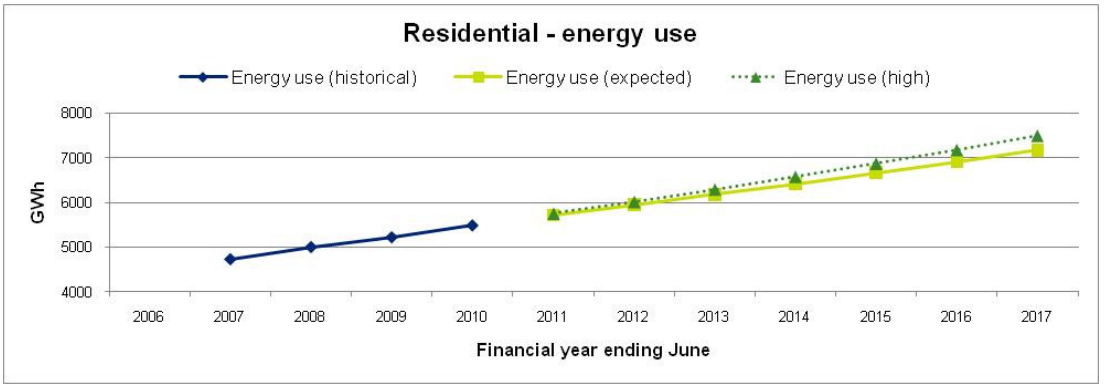
[22] Growth rates based on projected household numbers in ABS Cat No. 3236.0, *Household and Family Projections, Australia 2006 to 2031*, Tables 1.15 and 1.16 (released 6 June 2010), Series III – as discussed in Section 3.3.1, a 0.1 percentage point premium has been added to the ABS projections in the high case..

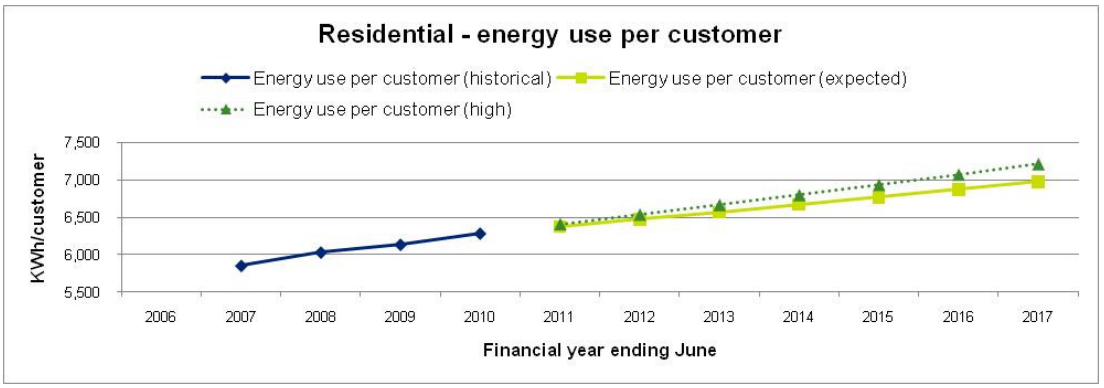
5 Forecast results

Applying the methodologies outlined above, we have produced the forecasts as outlined in the figures for each of “customer numbers”, “aggregate energy use” and “energy use per customer” below for each customer category. It is acknowledged that there are some discontinuities in the paths of the historic and forecast trends for some of the categories of customers depicted below. Given the datasets on which these forecasts are based could be enhanced going forward (refer to *Appendix A: Opportunities to improve forecast information*), detailed commentary on the reasoning for the apparent discontinuities would not have statistical robustness. The performance of the aggregate level forecast results against other benchmarks is discussed in Section 6. The numbers corresponding to these forecasts are presented in *Appendix B: Tabulated forecast results*.

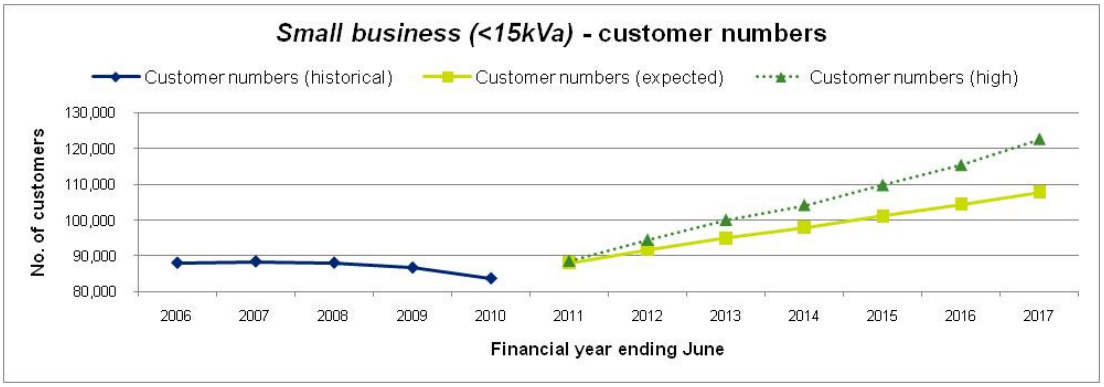
5.1 Residential

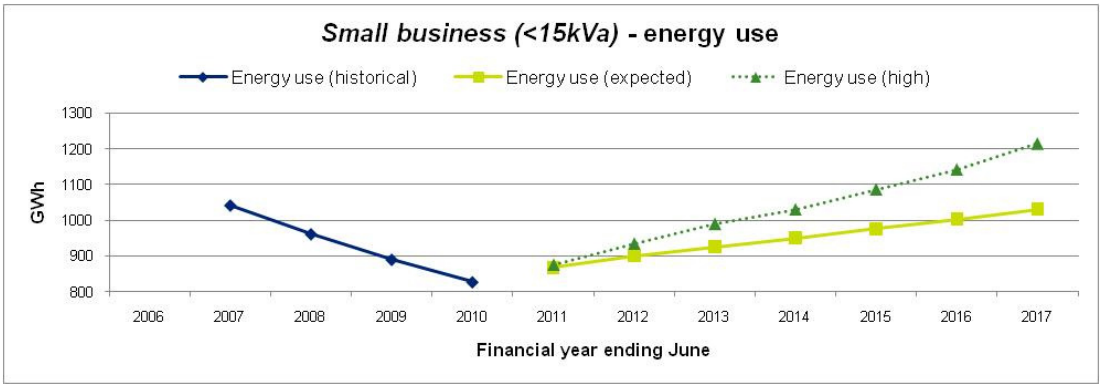


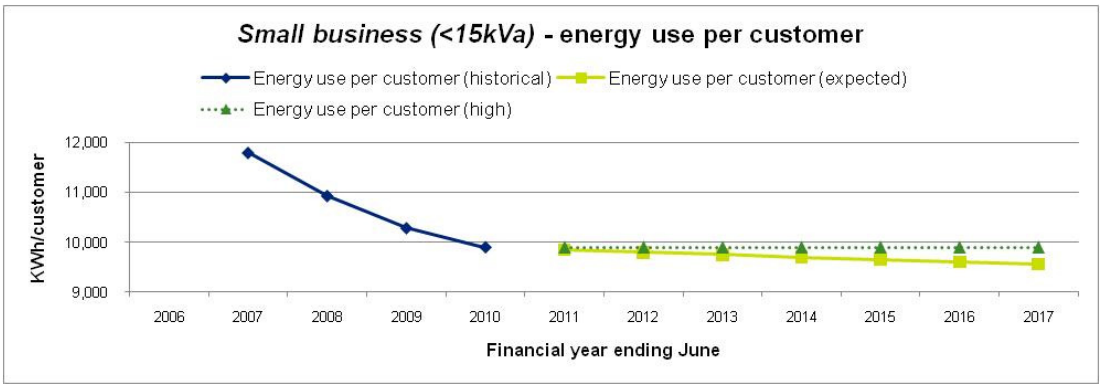




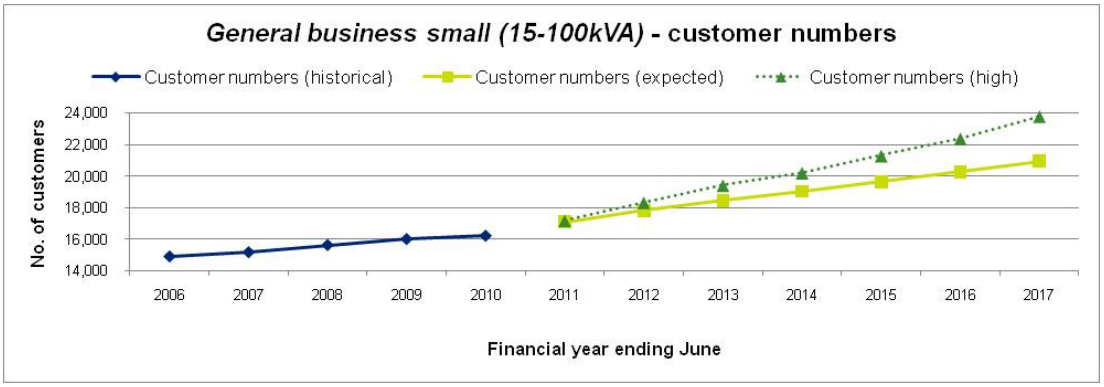
5.2 Small business: < 15kVA

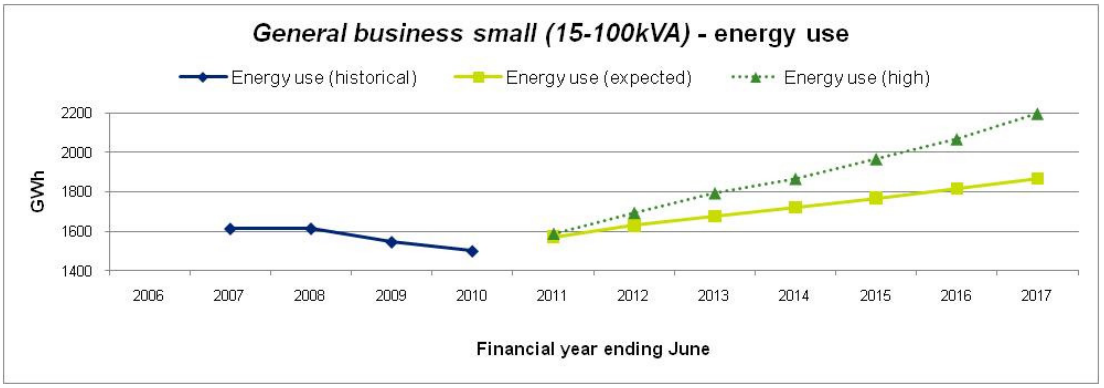


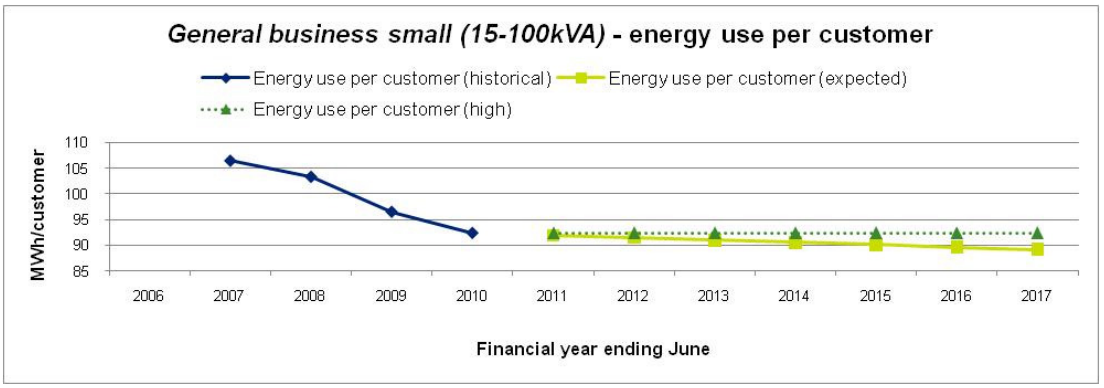




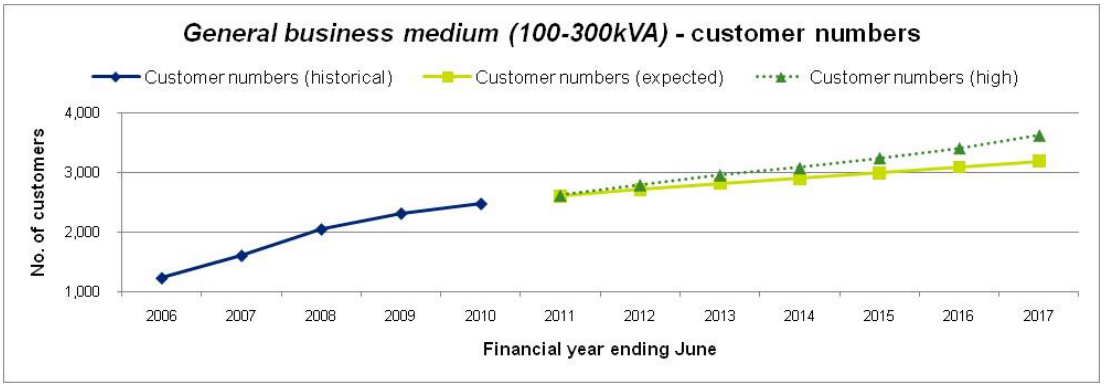
5.3 General business small: 15kVA – 100kVA

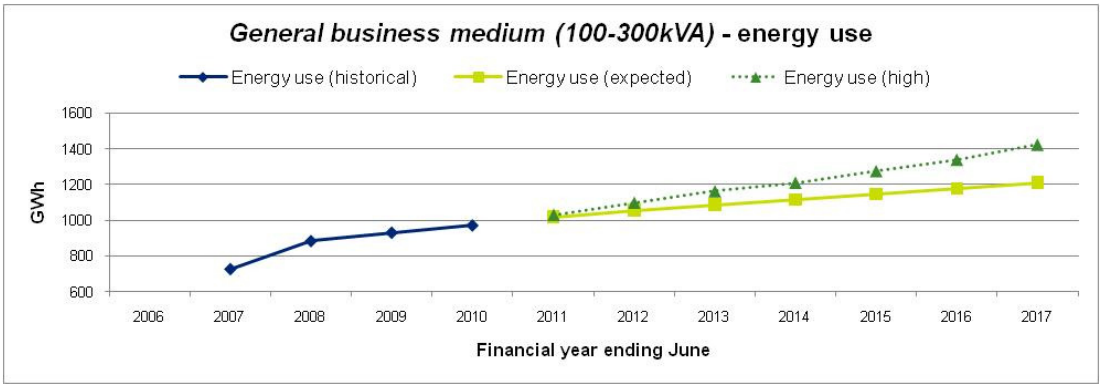


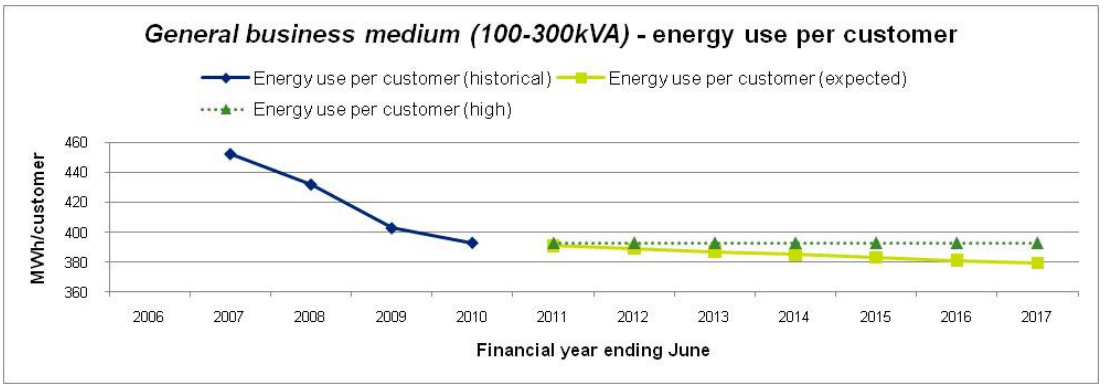




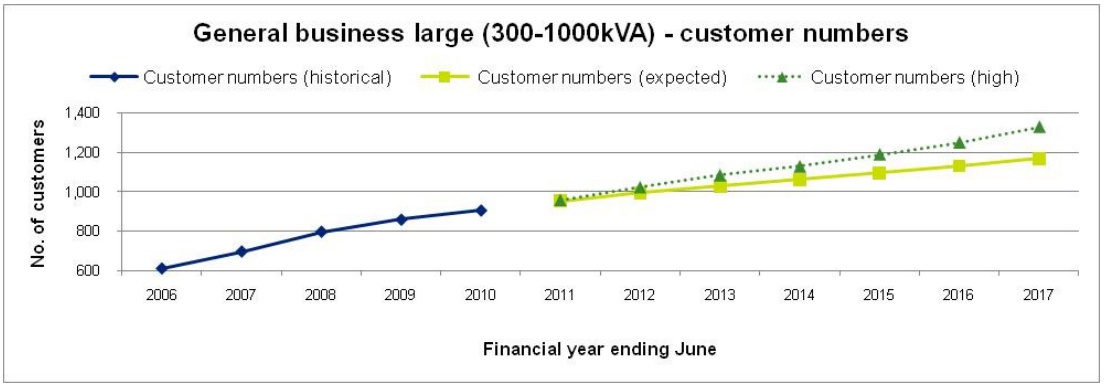
5.4 General business medium: 100 – 300kVA

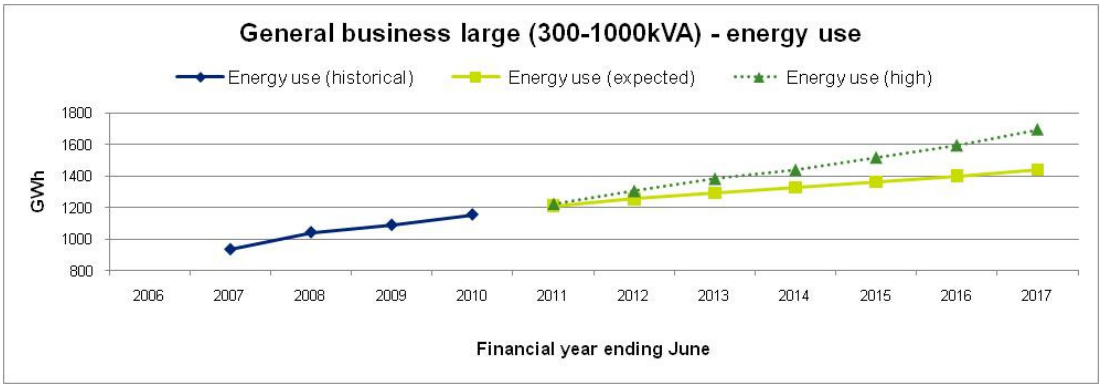


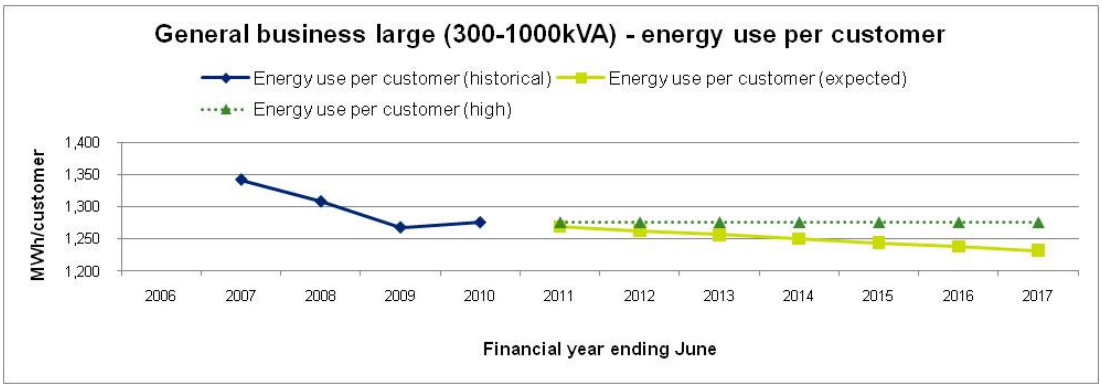




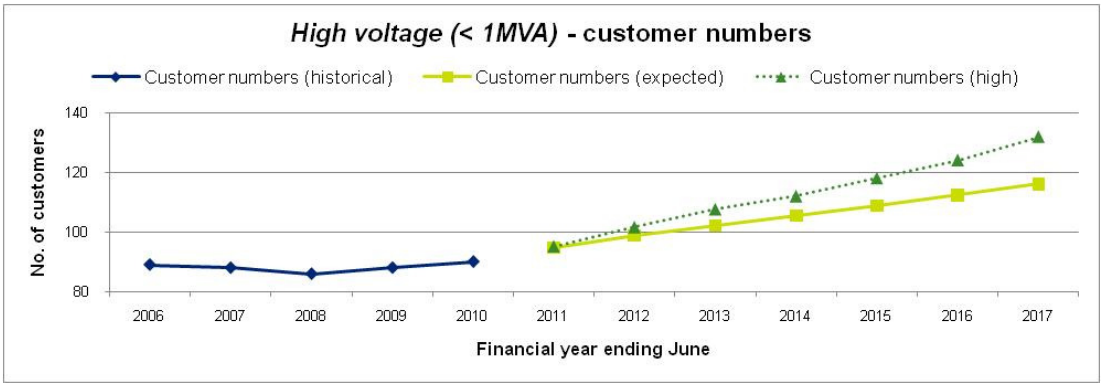
5.5 General business large: 300 – 1000 kVA

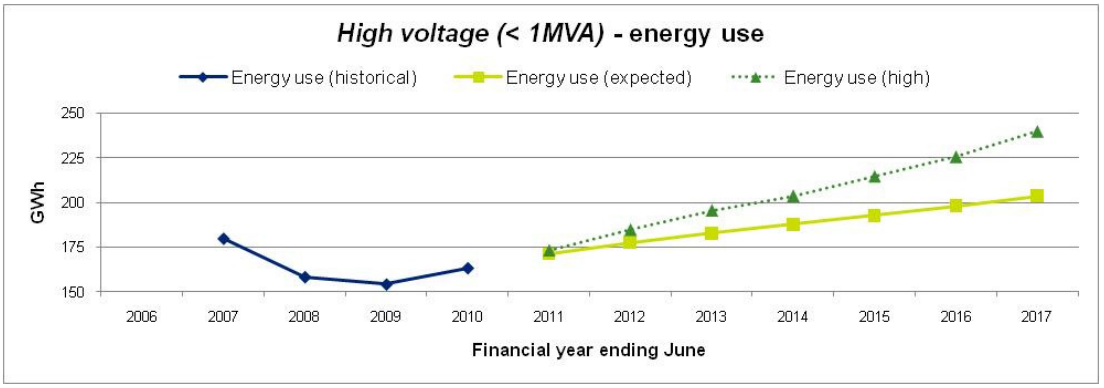


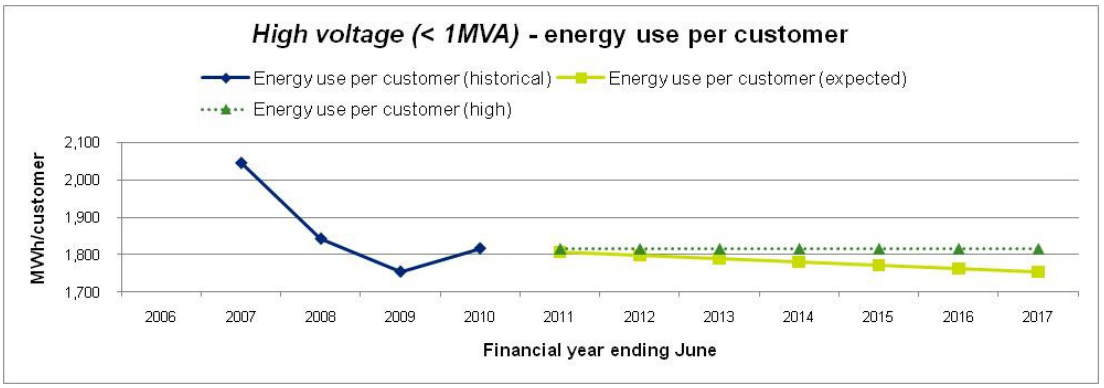




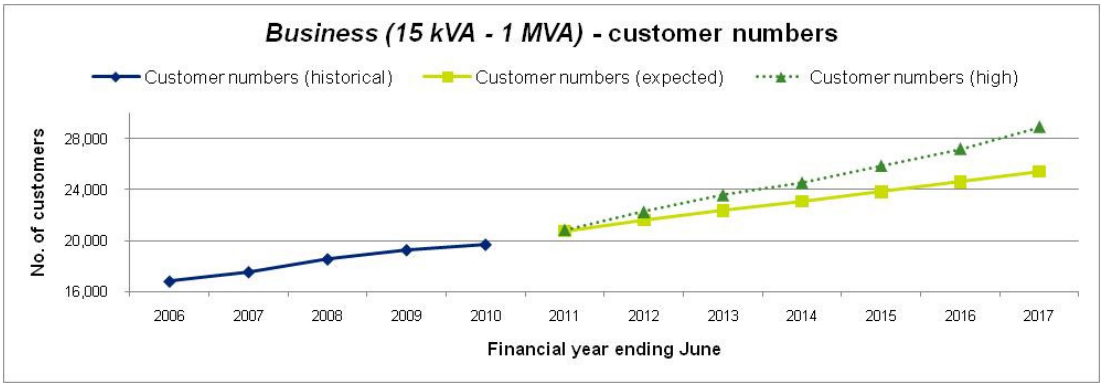
5.6 High voltage: < 1MVA

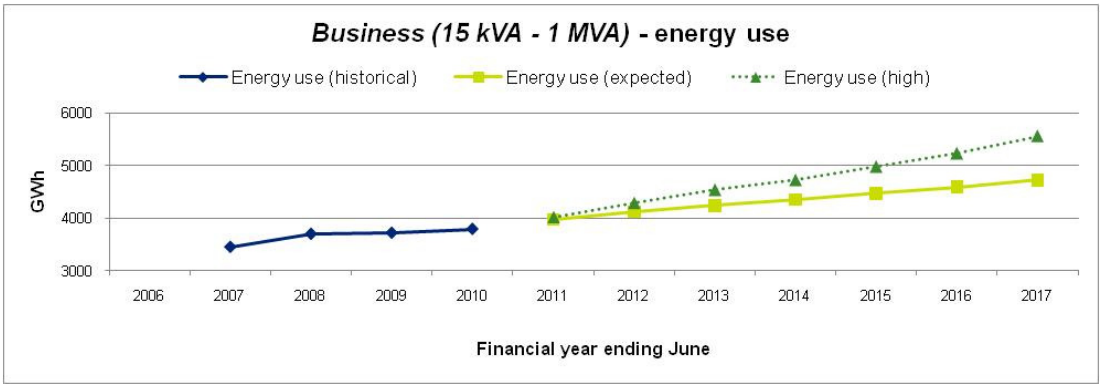


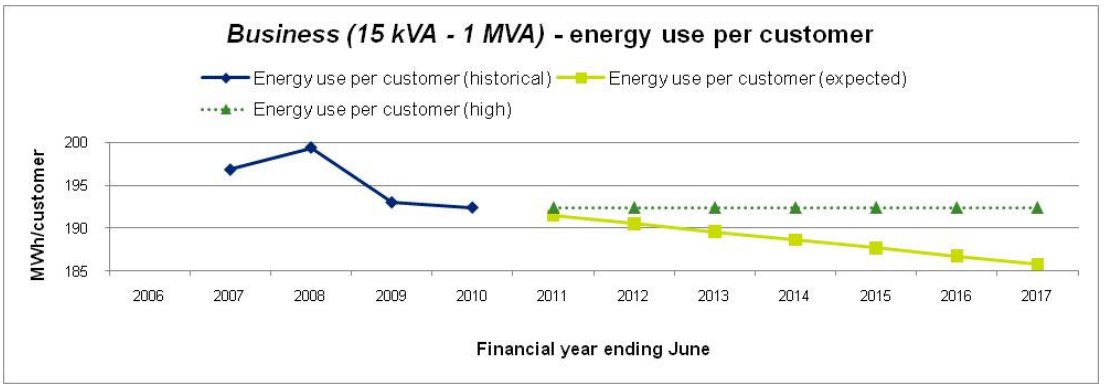




5.7 Business: 15kVA – 1000kVA

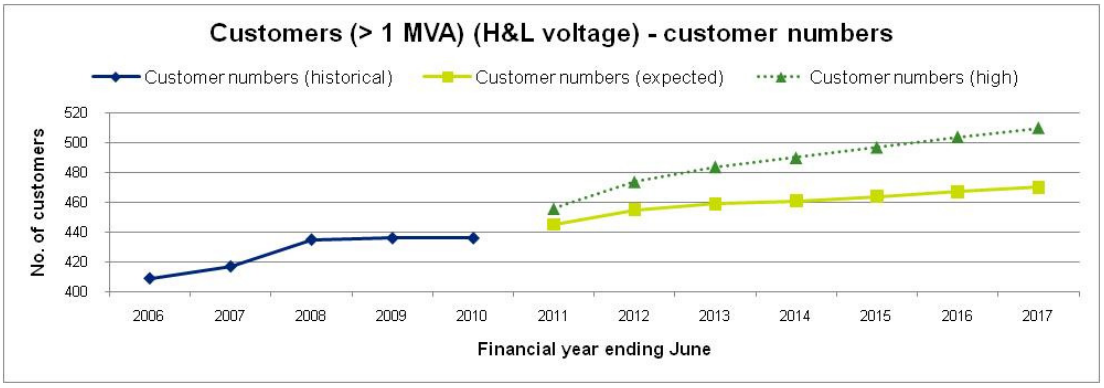


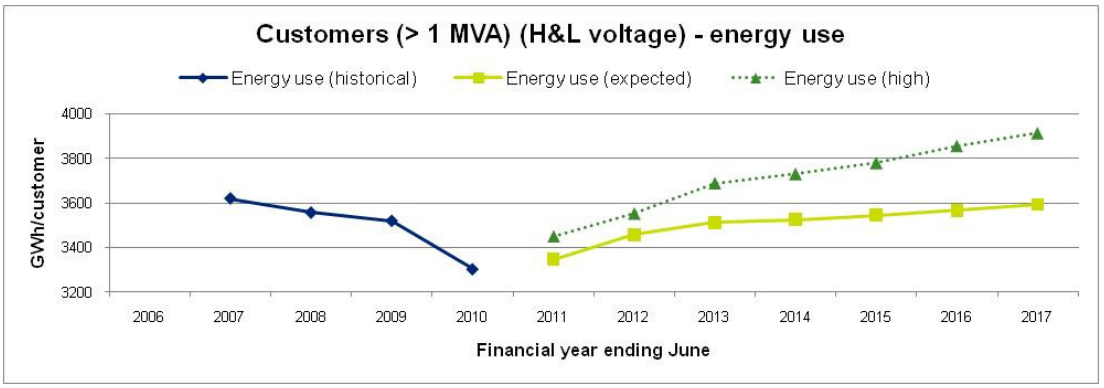


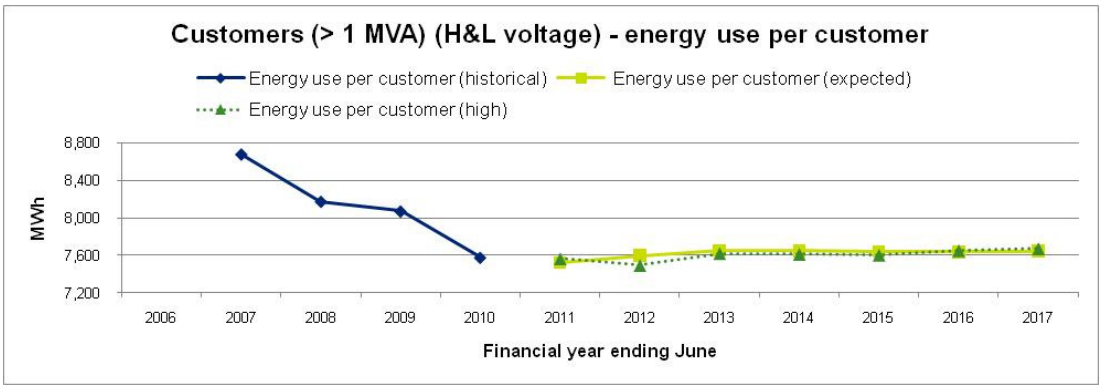


5.8 Very large customers

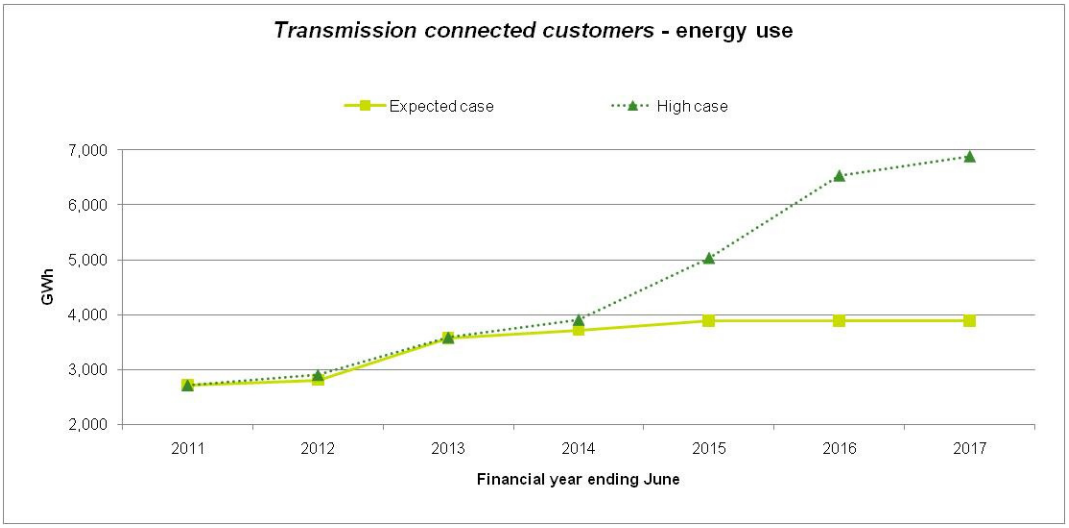
5.8.1 (Distribution connected) high and low voltage: > 1MVA







5.8.2 Transmission connected customers



5.9 System level forecasts

The combination of the individual forecasts from each of these groups, together with estimates of distribution losses and transmission losses, enables the development of system level forecasts.

Although we have not been provided with any extended history of the energy contribution from distribution losses, transmission losses or transmission connected load, Western Power has supplied estimates of the contribution of each of these factors in the 2009/10 financial year.

Table 13: Accounting for components of system energy: 2009/10

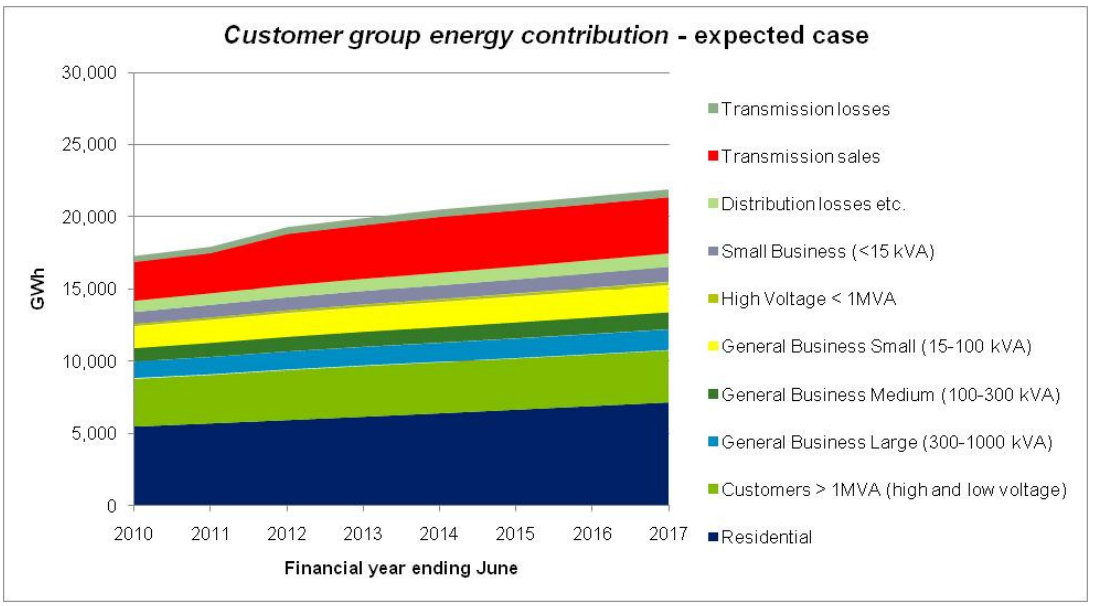
	GWh in 2009/10
Distribution connected loads (< 1MVA)	10,116
Distribution connected block loads (>1MVA)	3,304
Distribution losses / streetlights / unmetered loads	758
Transmission connected load block loads	2,714
Transmission losses	434

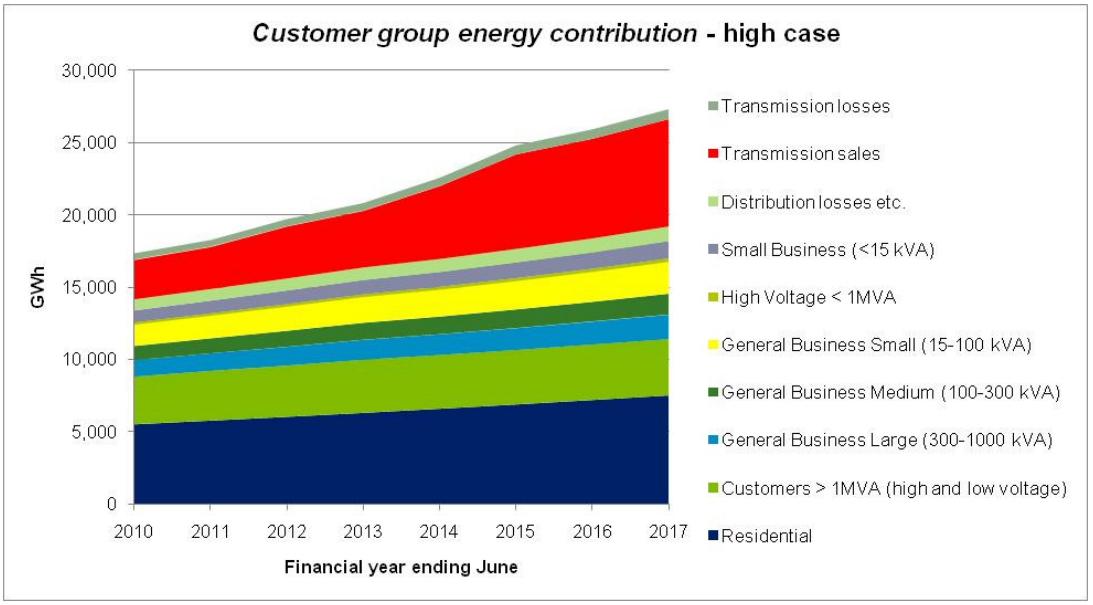
In developing projections of system energy, it has been assumed that:

- distribution losses / streetlights / unmetered loads as a share of distribution system sales remains constant (at 5.65%)
- transmission losses as a share of distribution sales + distribution losses + transmission sales remains constant (at 2.57%).

Other components of system load are forecast in accordance with the methodology outlined in Section 3.

The system level results, outlining each customer group energy contribution for each of the expected case and the high case are presented in the following two figures.


Customer group energy contribution - expected case
30,000
25,000
20,000
15,000
10,000
5,000
0
GWh
2010
2011
2012
2013
2014
2015
2016
2017
Financial year ending June
Transmission losses
Transmission sales
Distribution losses etc.
Small Business (<15 kVA)
High Voltage < 1MVA
General Business Small (15-100 kVA)
General Business Medium (100-300 kVA)
General Business Large (300-1000 kVA)
Customers > 1MVA (high and low voltage)
Residential


Customer group energy contribution - high case
30,000
25,000
20,000
15,000
10,000
5,000
0
GWh
2010
2011
2012
2013
2014
2015
2016
2017
Financial year ending June
Transmission losses
Transmission sales
Distribution losses etc.
Small Business (<15 kVA)
High Voltage < 1MVA
General Business Small (15-100 kVA)
General Business Medium (100-300 kVA)
General Business Large (300-1000 kVA)
Customers > 1MVA (high and low voltage)
Residential

6 Validation of forecasts

The forecasts outlined in Section 5 have been produced using a bottom-up approach – that is, we have separately applied a methodology to forecasting energy and customer numbers for each of seven customer groups:

- Residential
- Very large customers (> 1MVA) – high & low voltage distribution and transmission
- General Business Large (300-1000 kVA)
- General Business Medium (100-300 kVA)
- General Business Small (15-100 kVA)
- High Voltage < 1MVA
- Small Business <15 kVA

These bottom-up forecasts produced can be benchmarked through:

- Examination of the relationship between aggregate energy growth forecasts and GSP growth forecasts
- Comparison of Deloitte forecasts with IMO system level energy forecasts and the implied energy forecast derived from the combination of Western Power's own maximum demand forecasts and load factor forecasts.

6.1 Relationship between growth in GSP and growth in energy

6.1.1 Historical relationships

Historically, energy growth has been slower than GSP growth in Western Australia and the eastern states' NEM regions. In the years since 2004/05 – the only period for which consistently measured data is available – the average annual growth rate in Australia's GDP has been 2.8%, with the corresponding growth rate in sent-out energy for the NEM and SWIN combined has been 1.4%. State-by-State comparisons are provided in Table 14.

Table 14: Historical annual average change in GSP and sent-out energy (2004/05 to 2009/10)

	GSP growth	Energy growth	Differential (GSP – energy)
NSW + ACT	2.3%	1.0%	1.3%
Victoria	2.5%	1.0%	1.5%
Queensland	3.1%	1.7%	1.4%
South Australia	2.8%	1.9%	0.9%
Western Australia	4.5%	3.3%[a]	1.2%
Tasmania	2.7%	1.0%	1.7%
Total	2.8%	1.4%	1.4%

a. SWIN only.

Over the period 2000/01 to 2009/10, the average growth rate in Western Australia GSP has been 4.9% and the average growth rate in SWIN sent-out energy has been 3.3%.[23]

6.1.2 Benchmark forecast relationships

A comparison of system level long term forecasts comparing GSP growth with energy growth is provided in Table 15.

Table 15: Comparison of AEMO, IMO and Deloitte system level forecasts for energy and GSP

	GSP growth	Aggregate energy growth
Expected case		
AEMO forecast for the NEM (2009/10 to 2019/20)	2.69%	2.1%
IMO forecast for the SWIN (2010/11 to 2020/21)	4.2%	3.7%
Deloitte forecast for the SWIN (2009/10 to 2016/17)	4.1%	3.4% (total system) 3.0% (distribution only)
High case		
AEMO forecast for the NEM (2009/10 to 2019/20)	3.37%	3.4%
IMO forecast for the SWIN (2010/11 to 2020/21)	5.2%	5.4%
Deloitte forecast for the SWIN (2009/10 to 2016/17)	4.9%	6.7% (total system) 4.4% (distribution only)

Sources: AEMO, *Statement of Opportunities*, 2010; Independent Market Operator (IMO), *Statement of Opportunities*, 2010.

The energy growth forecasts from Deloitte for the SWIN are skewed by the incorporation of Western Power's expectations of block load connections (see Section 3.5) – especially the contribution to that total by transmission sales (see Section 5.9). When considering only growth in energy from distribution customers, the differential between GSP growth rates and distribution energy growth rates is around the historical value in the expected case. In the high cases energy growth is higher than GSP growth due to transmission connection of large developments with much greater than average energy intensity.[24]

At the distribution connection level, the recent regulatory determinations for distribution businesses in New South Wales and Victoria reflect an expectation of the 'GSP growth less than energy growth' pattern continuing – see Table 16.

[23] Based on a figures for energy production in the period 2000-01 to 2009-10 measured 'behind the fence'. Data sourced via email from Mark McKinnon (Western Power) to Stuart James (Deloitte) dated 4/11/10.

[24] According to Western Power's Block Load Tracker, the key developments in this respect relate to the Grange Resources mine, Asia Iron Ltd's Extension Hill mine and the Gindalbie project. The combined annual energy contribution for these projects alone estimated at close to 2400 GWh per annum – or nearly 10% of forecast total SWIN load by June 2017.

Table 16: Interstate comparison of forecast changes for distribution connected customers

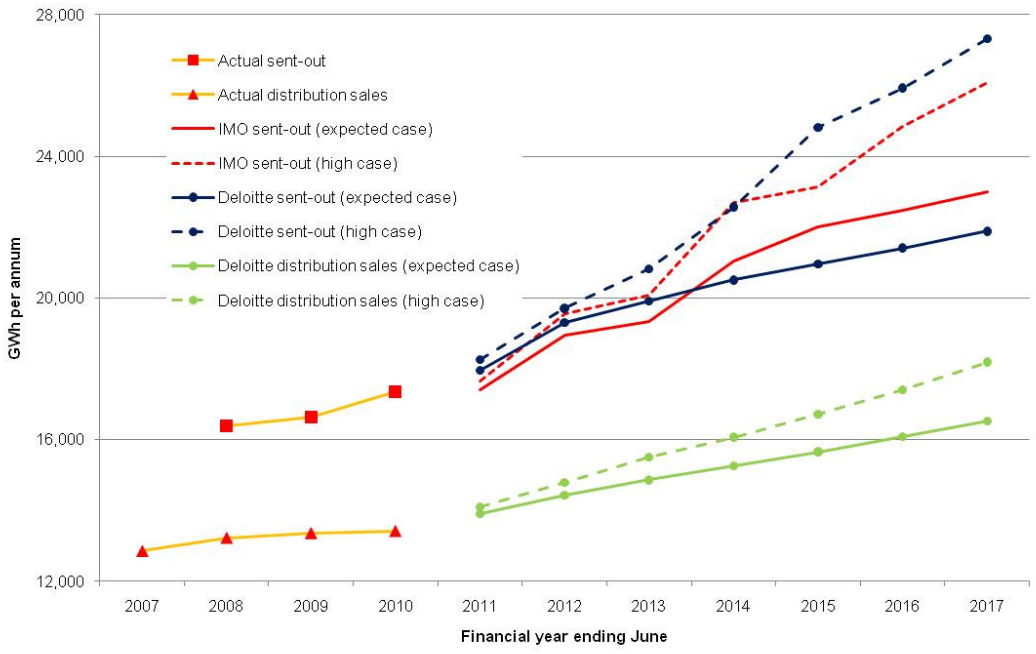
	GSP growth	Aggregate energy growth	Distribution customer number growth	Energy use per customer
New South Wales: AER determination for 2009/10 to 20013/14	2% to 2.5%	0.3%	1.0%	-0.7%
Victoria: AER determination for 2009/10 to 20013/14	Approx 2%	0.0%	1.5%	-1.5%
SWIN: Deloitte forecast for 2012/13 to 2016/17	3.6%	2.7%	2.5%	0.5%

Table 16 also indicates trends in the average energy use of all distribution connected customers, residential and business. As noted in Section 3.3.2, the trend in per household (residential) consumption is downwards in New South Wales and Victoria, unlike the upward trend in Western Australia. The circumstances described in Section 3.3.2 help rationalise the differences in the energy use per customer for all distribution connected customers.

6.2 IMO energy forecasts and Western Power load factor forecasts

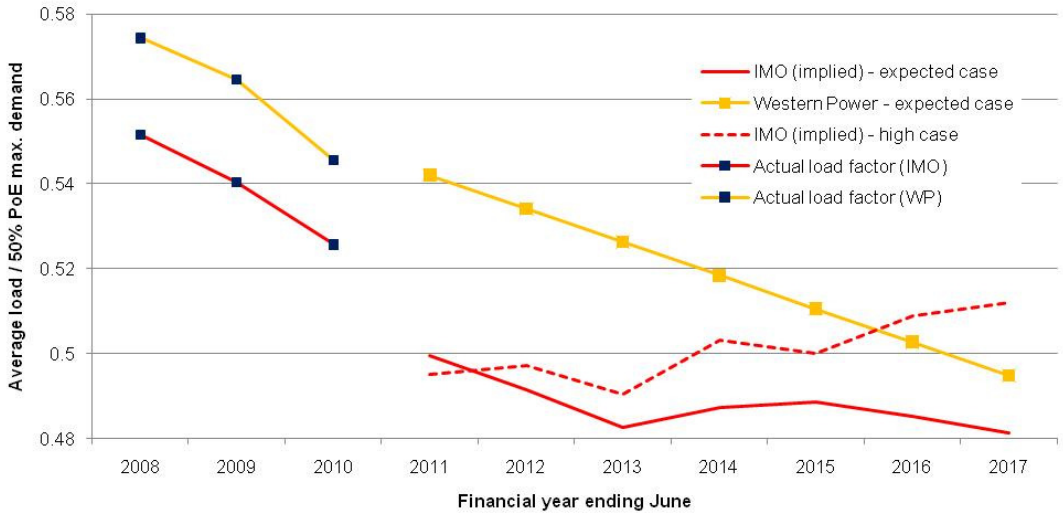
Figure 4 provides a comparison of the energy forecasts contained herein with those from IMO's 2010 Statement of Opportunities. The expected case forecast herein is below that of the IMO expected case forecast notwithstanding the similar views on the rate of economic growth over the forecast period.

Figure 4: Comparison of alternative load forecasts



Although Western Power has not produced its own energy forecasts, it has produced both maximum demand forecasts and load factor forecasts. A comparison of the Western Power load factor forecasts and the implied IMO load factor forecasts is provided in Figure 5. It is understood that the basis on which peak demand is measured by Western Power is different to the basis on which peak demand is measured by IMO – hence the differences in the historical measures of load factor. The extent of the discontinuities between history and forecast, and changes in the forecast path of load factors, will also lead to differences in (implied) energy forecasts.

Figure 5: Load factor forecasts – Western Power and IMO



Putting Western Power's maximum demand and load factor forecasts together produces an implied energy forecast. The comparison of IMO, (implied) Western Power and Deloitte sent out energy forecasts is presented in Figure 6.

The variance between the Deloitte expected case sent-out energy forecast and the (implied) Western Power expected case sent-out energy forecast is up to 4.8% in the earlier part of the outlook period but falls to around (negative) 1.1% at the end. This variance is relatively small compared to some of the other forecasts and, given that the Western Power and Deloitte forecasts have been prepared on quite different bases, suggests a reasonable level of internal consistency between Western Power's expected demand forecast ("central forecast") and the Deloitte expected energy forecast.

Figure 6: Sent-out energy forecasts – IMO, (implied) Western Power and Deloitte

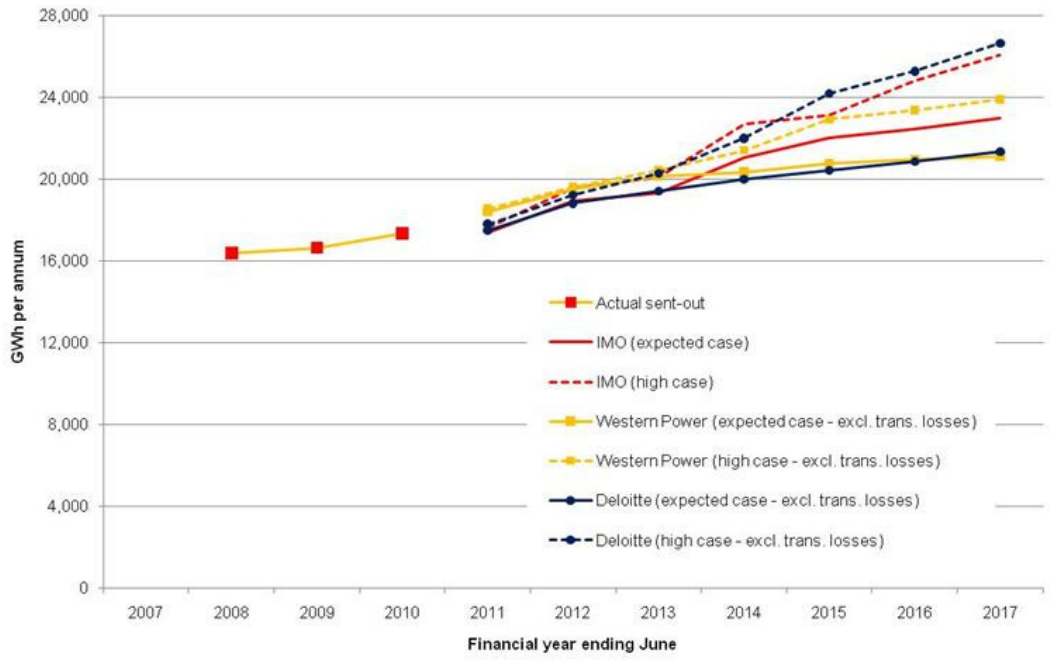


Table 17: Annual percentage energy growth rates – forecast period

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
IMO (expected case)	0.38%	8.82%	1.99%	8.90%	4.59%	2.14%	2.32%
IMO (high case)	1.80%	10.73%	2.74%	13.02%	1.86%	7.41%	5.02%
Western Power (expected case – excl. Trans. losses)	8.89%	6.16%	3.08%	1.12%	2.02%	0.83%	0.75%
Western Power (high case – excl. Trans. losses)	9.93%	5.68%	4.17%	4.70%	7.09%	1.94%	2.28%
Deloitte (expected case – excl. Trans. losses)	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%
Deloitte (high case – excl. Trans. losses)	5.34%	7.96%	5.63%	8.43%	9.97%	4.47%	5.38%

7 Summary

We believe that the forecasts contained herein reflect, as best as is possible given the information available, each of the principles of good practice forecasting as outlined in Section 2.1.

The energy / GSP growth differential identified in Section 6.1 provides Deloitte with reassurance that the distribution level forecasts contained herein are reasonable. Further, Deloitte's forecasts are not inconsistent with the recent regulatory determinations applied to New South Wales and Victoria.

However, when the effect of transmission connected load is considered, the conclusion of reasonableness is less certain. There are substantial differences in the expected case and high outcomes for transmission connection of block loads – differences that may be attributable to discretion in the categorisation of potential future block loads.

In conclusion, given:

- the short history of available data with which energy use and customer number trends might be correlated against consistently measured economic aggregates
- the apparent sensitivities in the expected and high case forecasts for block loads

Deloitte believes the forecasts are better suited to use under a revenue cap form of price control.

To enhance robustness of forecasts in preparation for a potential price cap form of price control, Deloitte would recommend:

- development of robustly measured longer term time series of historical observations of customer numbers and energy use
- assessment of correlations of robustly measured longer term time series against consistently measured economic aggregates.

Appendix A: Opportunities to improve forecast information

As noted in the introduction to this report and at various stages through the report, the ability to develop robust forecasts at the level desired was limited by the extent of available data. Following are some observations relating to the specifics of Deloitte's experience around the availability and management of datasets that should be considered when future energy and customer number forecasting exercises are contemplated.

These matters should be addressed as part of the process of moving towards a set of forecasts sufficiently robust to be applied within a weighted average price cap regime.

Database development

Western Power is likely to benefit from greater reporting alignment between its database and the customer groups and tariffs against which it wishes to forecast.

In extracting data to support this forecasting exercise, it was apparent that there is currently no system in place that allows simple reporting of energy usage against the customer groups and tariffs that are the basis for customer connections. The inability to readily extract such information from existing systems hampers the ability to perform timely analysis. However, it is understood that Western Power is currently developing a data-warehouse for the metering system to facilitate reporting and data extraction by tariff and customer group.

Access to consistently measured time series

Forecasting processes are assisted by access to a lengthy time series of consistently measured energy and customer numbers. Such datasets allow validation of forecasts through backcasting and benchmarking techniques.

Lack of access to long term data was apparent in two broad areas:

1. a long time series of consistently measured actual and forecast values relating to energy use and customer numbers. The more granular the data to which ready access is available, the more sophisticated can be the techniques that can be applied to data analysis
2. forecasts of distribution system metered energy from 2009/10 to 2016/17. For this type of forecasting exercise, the following tools are desirable:
   - a reasonably long historical time series of the variable we are required to forecast – to facilitate backcasting
   - some series that have similar characteristics to the series we are trying to forecast with both a reasonably long historical time series of observations and a matching

set of forecasts that were in some way tied with a common base[25] – to facilitate benchmarking.

For this exercise we had limited opportunity for either backcasting or benchmarking. The alternative system load measures available were as follows:

a) Supplied by Western Power: annual observations from 2005/06 to 2009/10 of distribution system metered energy

b) Supplied by Western Power: annual observations from 2000/01 to 2009/10 of aggregate generation from system connected generation understood to be measured at 'generator terminals'

c) Supplied by the IMO: half-hourly measures of energy 'sent-out' from September 2006 (market start) to September 2010 from which we were able to develop three annual observations from 2007/08 to 2009/10

d) Sourced from the IMO's *Statement of Opportunities*: annual forecasts of energy 'sent-out' from 2010/11 to 2020/21 – although we understood these numbers to be defined on the same basis as those in item c), together they do not form a continuous series because the forecasts were developed sometime prior to the end of 2009/10 and the IMO does not reveal the assumed 2009/10 value that forms the baseline of the forecasts from 2010/11 onwards.

Information on very large customer connections

Accurate forecasting relies not only on access to reliable trend information on 'normal' customers, but also access to accurate information on the potential connection of very large customers whose activity is difficult to forecast because of the lumpy nature of the investments involved.

As noted in Section 3.5, some elements of data that might be relevant to an energy forecast are not captured by Western Power's block load tracking tool. Western Power would therefore benefit from more effective capture of connection enquiry information with respect to all potential large block loads (say, over 0.5 MVA) to ensure records:

- capture information on expected energy consumption as well as peak load requirements
- specifically note whether sub-station upgrade is required.

[25] An example of this would be the AEMO projections of energy and maximum demand that have an historical series that is expressly linked to the forecast series through a common starting value.

Appendix B: Tabulated forecast results

Table 18: Energy by customer group (GWh) – expected case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	n.a.	4,730	5,007	5,229	5,498	5,720	5,946	6,177	6,416	6,663	6,915	7,172
Small Business (<15 kVA)	n.a.	1,043	962	891	828	867	900	926	951	976	1,003	1,031
General Business Small (15-100 kVA)	n.a.	1,613	1,613	1,545	1,499	1,571	1,629	1,677	1,722	1,768	1,817	1,867
General Business Medium (100-300 kVA)	n.a.	727	884	931	972	1,019	1,056	1,088	1,117	1,146	1,178	1,211
General Business Large (300-1000 kVA)	n.a.	934	1,042	1,089	1,156	1,211	1,256	1,293	1,327	1,363	1,401	1,440
High Voltage < 1MVA	n.a.	180	158	154	163	171	178	183	188	193	198	204
Customers >1MVA (high & low voltage)	n.a.	3,619	3,556	3,519	3,304	3,347	3,457	3,512	3,525	3,545	3,567	3,592
Total distribution system	n.a.	***12,845***	***13,224***	***13,359***	***13,420***	***13,907***	***14,421***	***14,856***	***15,246***	***15,654***	***16,080***	***16,517***

Table 19: Energy by customer group (% growth) – expected case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	5.86%	4.43%	5.14%	4.04%	3.95%	3.88%	3.87%	3.85%	3.78%	3.72%
Small Business (<15 kVA)	-7.77%	-7.38%	-7.07%	4.71%	3.81%	2.89%	2.70%	2.63%	2.77%	2.79%
General Business Small (15-100 kVA)	0.00%	-4.22%	-2.98%	4.80%	3.69%	2.95%	2.68%	2.67%	2.77%	2.75%
General Business Medium (100-300 kVA)	21.60%	5.32%	4.40%	4.84%	3.63%	3.03%	2.67%	2.60%	2.79%	2.80%
General Business Large (300-1000 kVA)	11.56%	4.51%	6.15%	4.76%	3.72%	2.95%	2.63%	2.71%	2.79%	2.78%
High Voltage < 1MVA	-12.22%	-2.53%	5.84%	4.91%	4.09%	2.81%	2.73%	2.66%	2.59%	3.03%
Customers >1MVA (high & low voltage)	-1.74%	-1.04%	-6.11%	1.30%	3.29%	1.59%	0.37%	0.57%	0.62%	0.70%
Total distribution system	**2.95%**	**1.02%**	**0.46%**	**3.63%**	**3.70%**	**3.02%**	**2.63%**	**2.68%**	**2.72%**	**2.72%**

Table 20: Customer numbers by customer group – expected case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	786,031	807,918	830,072	852,312	875,153	897,157	918,707	940,318	962,228	984,377	1,006,546	1,028,496
Small Business (<15 kVA)	88,012	88,394	88,047	86,648	83,643	88,084	91,807	94,994	98,007	101,138	104,475	107,906
General Business Small (15-100 kVA)	14,877	15,155	15,620	16,011	16,227	17,089	17,811	18,429	19,014	19,621	20,269	20,934
General Business Medium (100-300 kVA)	1,230	1,606	2,047	2,313	2,475	2,606	2,717	2,811	2,900	2,993	3,091	3,193
General Business Large (300-1000 kVA)	609	696	797	859	906	954	994	1,029	1,062	1,096	1,132	1,169
High Voltage < 1MVA	89	88	86	88	90	95	99	102	105	109	112	116
Customers >1MVA (high & low voltage)	409	417	435	436	436	445	455	459	461	464	467	470
Total distribution system	*891,257*	*914,274*	*937,104*	*958,667*	*978,930*	*1,006,430*	*1,032,589*	*1,058,143*	*1,083,776*	*1,109,797*	*1,136,093*	*1,162,284*

Table 21: Customer numbers by customer group (% growth) – expected case

	Actual				Forecasts						
	2006/07	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	2.78%	2.74%	2.68%	2.68%	2.51%	2.40%	2.35%	2.33%	2.30%	2.25%	2.18%
Small Business (<15 kVA)	0.43%	-0.39%	-1.59%	-3.47%	5.31%	4.23%	3.47%	3.17%	3.19%	3.30%	3.28%
General Business Small (15-100 kVA)	1.87%	3.07%	2.50%	1.35%	5.31%	4.22%	3.47%	3.17%	3.19%	3.30%	3.28%
General Business Medium (100-300 kVA)	30.57%	27.46%	12.99%	7.00%	5.29%	4.26%	3.46%	3.17%	3.21%	3.27%	3.30%
General Business Large (300-1000 kVA)	14.29%	14.51%	7.78%	5.47%	5.30%	4.19%	3.52%	3.21%	3.20%	3.28%	3.27%
High Voltage < 1MVA	-1.12%	-2.27%	2.33%	2.27%	5.56%	4.21%	3.03%	2.94%	3.81%	2.75%	3.57%
Customers >1MVA (high & low voltage)	1.96%	4.32%	0.23%	0.00%	2.06%	2.25%	0.88%	0.44%	0.65%	0.65%	0.64%
Total distribution system	***2.58%***	***2.50%***	***2.30%***	***2.11%***	***2.81%***	***2.60%***	***2.47%***	***2.42%***	***2.40%***	***2.37%***	***2.31%***

Table 22: Energy by customer group (GWh) – high case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	n.a.	4,730	5,007	5,229	5,498	5,754	6,020	6,294	6,580	6,877	7,183	7,500
Small Business (<15 kVA)	n.a.	1,043	962	891	828	877	935	991	1,031	1,087	1,142	1,214
General Business Small (15-100 kVA)	n.a.	1,613	1,613	1,545	1,499	1,588	1,694	1,794	1,867	1,968	2,069	2,199
General Business Medium (100-300 kVA)	n.a.	727	884	931	972	1,030	1,099	1,163	1,211	1,276	1,342	1,426
General Business Large (300-1000 kVA)	n.a.	934	1,042	1,089	1,156	1,224	1,306	1,383	1,440	1,517	1,595	1,695
High Voltage < 1MVA	n.a.	180	158	154	163	173	185	196	204	215	226	240
Customers >1MVA (high & low voltage)	n.a.	3,619	3,556	3,519	3,304	3,450	3,552	3,689	3,730	3,780	3,856	3,913
Total distribution system	n.a.	***12,845***	***13,224***	***13,359***	***13,420***	***14,095***	***14,791***	***15,509***	***16,063***	***16,720***	***17,412***	***18,187***

Table 23: Energy by customer group (% growth) – high case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	5.86%	4.43%	5.14%	4.66%	4.62%	4.55%	4.54%	4.51%	4.45%	4.41%
Small Business (<15 kVA)	-7.77%	-7.38%	-7.07%	5.92%	6.61%	5.99%	4.04%	5.43%	5.06%	6.30%
General Business Small (15-100 kVA)	0.00%	-4.22%	-2.98%	5.94%	6.68%	5.90%	4.07%	5.41%	5.13%	6.28%
General Business Medium (100-300 kVA)	21.60%	5.32%	4.40%	5.97%	6.70%	5.82%	4.13%	5.37%	5.17%	6.26%
General Business Large (300-1000 kVA)	11.56%	4.51%	6.15%	5.88%	6.70%	5.90%	4.12%	5.35%	5.14%	6.27%
High Voltage < 1MVA	-12.22%	-2.53%	5.84%	6.13%	6.94%	5.95%	4.08%	5.39%	5.12%	6.19%
Customers >1MVA (high & low voltage)	-1.74%	-1.04%	-6.11%	4.42%	2.96%	3.86%	1.11%	1.34%	2.01%	1.48%
Total distribution system	**2.95%**	**1.02%**	**0.46%**	**5.03%**	**4.94%**	**4.85%**	**3.57%**	**4.09%**	**4.14%**	**4.45%**

Table 24: Customer numbers by customer group – high case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	786,031	807,918	830,072	852,312	875,153	898,032	921,020	944,131	967,594	991,357	1,015,205	1,039,164
Small Business (<15 kVA)	88,012	88,394	88,047	86,648	83,643	88,578	94,513	100,089	104,193	109,819	115,420	122,691
General Business Small (15-100 kVA)	14,877	15,155	15,620	16,011	16,227	17,184	18,336	19,418	20,214	21,305	22,392	23,802
General Business Medium (100-300 kVA)	1,230	1,606	2,047	2,313	2,475	2,621	2,797	2,962	3,083	3,250	3,415	3,630
General Business Large (300-1000 kVA)	609	696	797	859	906	959	1,024	1,084	1,129	1,190	1,250	1,329
High Voltage < 1MVA	89	88	86	88	90	95	102	108	112	118	124	132
Customers >1MVA (high & low voltage)	409	417	435	436	436	456	474	484	490	497	504	510
Total distribution system	***891,257***	***914,274***	***937,104***	***958,667***	***978,930***	***1,007,926***	***1,038,264***	***1,068,275***	***1,096,814***	***1,127,536***	***1,158,311***	***1,191,259***

Table 25: Customer numbers by customer group (% growth) – high case

	Actual				Forecasts						
	2006/07	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Residential	2.78%	2.74%	2.68%	2.68%	2.61%	2.56%	2.51%	2.49%	2.46%	2.41%	2.36%
Small Business (<15 kVA)	0.43%	-0.39%	-1.59%	-3.47%	5.90%	6.70%	5.90%	4.10%	5.40%	5.10%	6.30%
General Business Small (15-100 kVA)	1.87%	3.07%	2.50%	1.35%	5.90%	6.70%	5.90%	4.10%	5.40%	5.10%	6.30%
General Business Medium (100-300 kVA)	30.57%	27.46%	12.99%	7.00%	5.90%	6.71%	5.90%	4.09%	5.42%	5.08%	6.30%
General Business Large (300-1000 kVA)	14.29%	14.51%	7.78%	5.47%	5.85%	6.78%	5.86%	4.15%	5.40%	5.04%	6.32%
High Voltage < 1MVA	-1.12%	-2.27%	2.33%	2.27%	5.56%	7.37%	5.88%	3.70%	5.36%	5.08%	6.45%
Customers >1MVA (high & low voltage)	1.96%	4.32%	0.23%	0.00%	4.59%	3.95%	2.11%	1.24%	1.43%	1.41%	1.19%
Total distribution system	**2.58%**	**2.50%**	**2.30%**	**2.11%**	**2.96%**	**3.01%**	**2.89%**	**2.67%**	**2.80%**	**2.73%**	**2.84%**

Table 26: Aggregated results by energy and customer numbers – expected case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)												
Business > 1MVA	n.a.	3,619	3,556	3,519	3,304	3,347	3,457	3,512	3,525	3,545	3,567	3,592
Business < 1MVA	n.a.	3,453	3,699	3,720	3,790	3,972	4,119	4,241	4,353	4,470	4,594	4,721
Residential and small business < 15kVA	n.a.	5,773	5,969	6,120	6,326	6,588	6,846	7,103	7,367	7,639	7,919	8,203
Total distribution system	n.a.	***12,845***	***13,224***	***13,359***	***13,420***	***13,907***	***14,421***	***14,856***	***15,246***	***15,654***	***16,080***	***16,517***
Customer numbers												
Business > 1MVA	409	417	435	436	436	445	455	459	461	464	467	470
Business < 1MVA	16,805	17,545	18,550	19,271	19,698	20,744	21,621	22,371	23,081	23,818	24,604	25,412
Residential and small business < 15kVA	874,043	896,312	918,119	938,960	958,796	985,241	1,010,514	1,035,313	1,060,235	1,085,515	1,111,022	1,136,402
Total distribution system	***891,257***	***914,274***	***937,104***	***958,667***	***978,930***	***1,006,430***	***1,032,589***	***1,058,143***	***1,083,776***	***1,109,797***	***1,136,093***	***1,162,284***

Table 27: Aggregated results by energy and customer numbers (% growth) – expected case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)										
Business > 1MVA	-1.74%	-1.04%	-6.11%	1.30%	3.29%	1.59%	0.37%	0.57%	0.62%	0.70%
Business < 1MVA	7.12%	0.57%	1.88%	4.80%	3.70%	2.96%	2.64%	2.69%	2.77%	2.76%
Residential and small business < 15kVA	3.40%	2.53%	3.37%	4.14%	3.92%	3.75%	3.72%	3.69%	3.67%	3.59%
Total distribution system	***2.95%***	***1.02%***	***0.46%***	***3.63%***	***3.70%***	***3.02%***	***2.63%***	***2.68%***	***2.72%***	***2.72%***
Customer numbers										
Business > 1MVA	4.32%	0.23%	0.00%	2.06%	2.25%	0.88%	0.44%	0.65%	0.65%	0.64%
Business < 1MVA	5.73%	3.89%	2.22%	5.31%	4.23%	3.47%	3.17%	3.19%	3.30%	3.28%
Residential and small business < 15kVA	2.43%	2.27%	2.11%	2.76%	2.57%	2.45%	2.41%	2.38%	2.35%	2.28%
Total distribution system	***2.50%***	***2.30%***	***2.11%***	***2.81%***	***2.60%***	***2.47%***	***2.42%***	***2.40%***	***2.37%***	***2.31%***

Table 28: Aggregated results by energy and customer numbers – high case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)												
Business > 1MVA	n.a.	3,619	3,556	3,519	3,304	3,450	3,552	3,689	3,730	3,780	3,856	3,913
Business < 1MVA	n.a.	3,453	3,699	3,720	3,790	4,014	4,283	4,536	4,722	4,977	5,231	5,560
Residential and small business < 15kVA	n.a.	5,773	5,969	6,120	6,326	6,631	6,955	7,285	7,611	7,964	8,326	8,714
Total distribution system		***12,845***	***13,224***	***13,359***	***13,420***	***14,095***	***14,791***	***15,509***	***16,063***	***16,720***	***17,412***	***18,187***
Customer numbers												
Business > 1MVA	409	417	435	436	436	456	474	484	490	497	504	510
Business < 1MVA	16,805	17,545	18,550	19,271	19,698	20,860	22,258	23,571	24,537	25,862	27,181	28,894
Residential and small business < 15kVA	874,043	896,312	918,119	938,960	958,796	986,610	1,015,532	1,044,220	1,071,786	1,101,176	1,130,625	1,161,855
Total distribution system	***891,257***	***914,274***	***937,104***	***958,667***	***978,930***	***1,007,926***	***1,038,264***	***1,068,275***	***1,096,814***	***1,127,536***	***1,158,311***	***1,191,259***

Table 29: Aggregated results by energy and customer numbers (% growth) – high case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)										
Business > 1MVA	-1.74%	-1.04%	-6.11%	4.42%	2.96%	3.86%	1.11%	1.34%	2.01%	1.48%
Business < 1MVA	7.12%	0.57%	1.88%	5.91%	6.70%	5.91%	4.10%	5.40%	5.10%	6.29%
Residential and small business < 15kVA	3.40%	2.53%	3.37%	4.82%	4.89%	4.74%	4.47%	4.64%	4.55%	4.66%
Total distribution system	***2.95%***	***1.02%***	***0.46%***	***5.03%***	***4.94%***	***4.85%***	***3.57%***	***4.09%***	***4.14%***	***4.45%***
Customer numbers										
Business > 1MVA	4.32%	0.23%	0.00%	4.59%	3.95%	2.11%	1.24%	1.43%	1.41%	1.19%
Business < 1MVA	5.73%	3.89%	2.22%	5.90%	6.70%	5.90%	4.10%	5.40%	5.10%	6.30%
Residential and small business < 15kVA	2.43%	2.27%	2.11%	2.90%	2.93%	2.82%	2.64%	2.74%	2.67%	2.76%
Total distribution system	***2.50%***	***2.30%***	***2.11%***	***2.96%***	***3.01%***	***2.89%***	***2.67%***	***2.80%***	***2.73%***	***2.84%***

Table 30: Residential customers for Perth and non-Perth SWIN – expected case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)												
Perth	n.a.	3,899	4,126	4,304	4,540	4,725	4,913	5,106	5,306	5,513	5,725	5,941
Non-Perth SWIN	n.a.	831	881	925	958	995	1,033	1,071	1,110	1,150	1,190	1,231
All residential customers	n.a.	***4,730***	***5,007***	***5,229***	***5,498***	***5,720***	***5,946***	***6,177***	***6,416***	***6,663***	***6,915***	***7,172***
Customer numbers												
Perth	639,862	657,482	675,014	693,100	711,939	730,045	747,867	765,769	783,996	802,479	821,022	839,459
Non-Perth SWIN	146,169	150,436	155,058	159,212	163,214	167,112	170,840	174,549	178,232	181,898	185,524	189,037
All residential customers	***786,031***	***807,918***	***830,072***	***852,312***	***875,153***	***897,157***	***918,707***	***940,318***	***962,228***	***984,377***	***1,006,546***	***1,028,496***

Table 31: Residential customers for Perth and non-Perth SWIN (% growth) – expected case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)										
Perth	5.82%	4.31%	5.48%	4.07%	3.98%	3.93%	3.92%	3.90%	3.85%	3.77%
Non-Perth SWIN	6.02%	4.99%	3.57%	3.86%	3.82%	3.68%	3.64%	3.60%	3.48%	3.45%
All residential customers	***5.86%***	***4.43%***	***5.14%***	***4.04%***	***3.95%***	***3.88%***	***3.87%***	***3.85%***	***3.78%***	***3.72%***
Customer numbers										
Perth	2.67%	2.68%	2.72%	2.54%	2.44%	2.39%	2.38%	2.36%	2.31%	2.25%
Non-Perth SWIN	3.07%	2.68%	2.51%	2.39%	2.23%	2.17%	2.11%	2.06%	1.99%	1.89%
All residential customers	**2.74%**	**2.68%**	**2.68%**	**2.51%**	**2.40%**	**2.35%**	**2.33%**	**2.30%**	**2.25%**	**2.18%**

Table 32: Residential customers for Perth and non-Perth SWIN – high case

	Actual					Forecasts						
	2005/06	**2006/07**	**2007/08**	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)												
Perth	n.a.	3,899	4,126	4,304	4,540	4,753	4,974	5,203	5,441	5,689	5,946	6,212
Non-Perth SWIN	n.a.	831	881	925	958	1,001	1,046	1,091	1,139	1,187	1,237	1,288
All residential customers	n.a.	***4,730***	***5,007***	***5,229***	***5,498***	***5,754***	***6,020***	***6,294***	***6,580***	***6,877***	***7,183***	***7,500***
Customer numbers												
Perth	639,862	657,482	675,014	693,100	711,939	730,757	749,730	768,835	788,301	808,080	827,972	848,020
Non-Perth SWIN	146,169	150,436	155,058	159,212	163,214	167,275	171,290	175,296	179,293	183,277	187,234	191,144
All residential customers	***786,031***	***807,918***	***830,072***	***852,312***	***875,153***	***898,032***	***921,020***	***944,131***	***967,594***	***991,357***	***1,015,205***	***1,039,164***

Table 33: Residential customers for Perth and non-Perth SWIN (% growth) – high case

	Actual			Forecasts						
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**
Energy (GWh)										
Perth	5.82%	4.31%	5.48%	4.69%	4.65%	4.60%	4.57%	4.56%	4.52%	4.47%
Non-Perth SWIN	6.02%	4.99%	3.57%	4.49%	4.50%	4.30%	4.40%	4.21%	4.21%	4.12%
All residential customers	**5.86%**	**4.43%**	**5.14%**	**4.66%**	**4.62%**	**4.55%**	**4.54%**	**4.51%**	**4.45%**	**4.41%**
Customer numbers										
Perth	2.67%	2.68%	2.72%	2.64%	2.60%	2.55%	2.53%	2.51%	2.46%	2.42%
Non-Perth SWIN	3.07%	2.68%	2.51%	2.49%	2.40%	2.34%	2.28%	2.22%	2.16%	2.09%
All residential customers	**2.74%**	**2.68%**	**2.68%**	**2.61%**	**2.56%**	**2.51%**	**2.49%**	**2.46%**	**2.41%**	**2.36%**

Table 34: System level energy forecasts (GWh) – expected case

	2009/10 (actual)	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Sales to distribution connected customers[a]	13,420	13,907	14,421	14,856	15,246	15,654	16,080	16,517
Distribution system losses etc.[b]	758	785	815	839	861	884	908	933
Sales to transmission connected customers[c]	2,714	2,812	3,580	3,721	3,887	3,887	3,887	3,887
Energy at sub-stations	*16,892*	*17,505*	*18,816*	*19,417*	*19,994*	*20,425*	*20,875*	*21,337*
Transmission system losses[b]	434	450	483	499	514	525	536	548
Sent-out energy	**17,326**	**17,954**	**19,300**	**19,915**	**20,507**	**20,950**	**21,411**	**21,885**

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 35: System level energy forecasts (% growth) – expected case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Sales to distribution connected customers[a]	3.63%	3.70%	3.02%	2.62%	2.68%	2.72%	2.72%
Distribution system losses etc.[b]	3.63%	3.70%	3.02%	2.62%	2.68%	2.72%	2.72%
Sales to transmission connected customers[c]	3.62%	27.32%	3.94%	4.45%	0.00%	0.00%	0.00%
Energy at sub-stations	*3.62%*	*7.49%*	*3.19%*	*2.97%*	*2.16%*	*2.20%*	*2.21%*
Transmission system losses[b]	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%
Sent-out energy	**3.62%**	**7.49%**	**3.19%**	**2.97%**	**2.16%**	**2.20%**	**2.21%**

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 36: System level energy forecasts (GWh) – high case

	2009/10 (actual)	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Sales to distribution connected customers[a]	13,420	14,095	14,791	15,509	16,063	16,720	17,412	18,187
Distribution system losses etc.[b]	758	796	835	876	907	944	983	1,027
Sales to transmission connected customers[c]	2,714	2,904	3,586	3,909	5,034	6,534	6,885	7,425
Energy at sub-stations	*16,892*	*17,795*	*19,212*	*20,294*	*22,005*	*24,198*	*25,280*	*26,639*
Transmission system losses[b]	434	457	494	521	565	622	650	684
Sent-out energy	**17,326**	**18,252**	**19,706**	**20,815**	**22,570**	**24,820**	**25,930**	**27,324**

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 37: System level energy forecasts (% growth) – high case

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Sales to distribution connected customers[a]	5.03%	4.94%	4.86%	3.57%	4.09%	4.14%	4.45%
Distribution system losses etc.[b]	5.03%	4.94%	4.86%	3.57%	4.09%	4.14%	4.45%
Sales to transmission connected customers[c]	7.00%	23.48%	8.99%	28.80%	29.78%	5.38%	7.84%
Energy at sub-stations	5.34%	7.96%	5.63%	8.43%	9.97%	4.47%	5.38%
Transmission system losses[b]	5.34%	7.96%	5.63%	8.43%	9.97%	4.47%	5.38%
Sent-out energy	**5.34%**	**7.96%**	**5.63%**	**8.43%**	**9.97%**	**4.47%**	**5.38%**

a. Deloitte building blocks basis

b. Assumed constant proportion as per data for 2009-10 presented in Section 5.9.

c. Developed from Western Power's "block load tracker".

Table 38: Comparison of system level forecasts from IMO, Western Power and Deloitte

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Maximum demand and load factors							
Western Power 50% PoE maximum demand (MWh, expected case)	3,874	4,173	4,366	4,482	4,643	4,755	4,867
Western Power 50% PoE maximum demand (MWh, high case)	3,911	4,194	4,434	4,713	5,125	5,306	5,513
Western Power 50% PoE load factor	54.20%	53.42%	52.63%	51.84%	51.06%	50.27%	49.48%
Sent-out energy (GWh, expected case)							
IMO	17,409	18,944	19,321	21,041	22,006	22,478	22,999
Western Power (excl. trans. losses)	18,395	19,527	20,129	20,355	20,767	20,940	21,098
Deloitte (excl. trans. losses)	17,505	18,816	19,417	19,994	20,425	20,875	21,337
Sent-out energy (GWh, high case)							
IMO	17,656	19,550	20,086	22,701	23,123	24,836	26,082
Western Power (excl. trans. losses)	18,570	19,625	20,443	21,404	22,922	23,366	23,898
Deloitte (excl. trans. losses)	17,795	19,212	20,294	22,005	24,198	25,280	26,639

Table 39: Comparison of system level forecasts from IMO, Western Power and Deloitte (% growth)

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Maximum demand and load factors							
Western Power 50% PoE maximum demand (MWh, expected case)	n/a	7.72%	4.62%	2.66%	3.59%	2.41%	2.36%
Western Power 50% PoE maximum demand (MWh, high case)	n/a	7.24%	5.72%	6.29%	8.74%	3.53%	3.90%
Sent-out energy (GWh, expected case)							
IMO	0.38%	8.82%	1.99%	8.90%	4.59%	2.14%	2.32%
Western Power (excl. trans. losses)	8.89%	6.16%	3.08%	1.12%	2.02%	0.83%	0.75%
Deloitte (excl. trans. losses)	3.62%	7.49%	3.19%	2.97%	2.16%	2.20%	2.21%
Sent-out energy (GWh, high case)							
IMO	1.80%	10.73%	2.74%	13.02%	1.86%	7.41%	5.02%
Western Power (excl. trans. losses)	9.93%	5.68%	4.17%	4.70%	7.09%	1.94%	2.28%
Deloitte (excl. trans. losses)	5.34%	7.96%	5.63%	8.43%	9.97%	4.47%	5.38%

Appendix C: Glossary of terms

AA3	Western Power's third Access Arrangement period – 2012-13 to 2016-17
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
ERA	Economic Regulatory Authority
GDP	gross domestic product
GSP	gross state product
IMO	Independent Market Operator
n.a.	not available
PoE	probability of exceedence – e.g. 10% PoE mean that a particular forecasts has a probability of being exceeded one year in ten
SFD	state final demand
SWIN	South West Interconnected Network

Appendix D: Glossary of tariff codes

RT1	A1 – Anytime Energy (Residential) Exit Service
RT2	A2 – Anytime Energy (Business) Exit Service
RT3	A3 – Time of Use Energy (Residential) Exit Service
RT4	A4 – Time of Use Energy (Business) Exit Service
RT5	A5 – High Voltage Metered Demand Exit Service
RT6	A6 – Low Voltage Metered Demand Exit Service
RT7	A7 – High Voltage Contract Maximum Demand Exit Service
RT8	A8 – Low Voltage Contract Maximum Demand Exit Service
RT9	A9 – Streetlighting Exit Service
RT10	A10 – Un-Metered Supplies Exit Service
TRT1	A11 – Transmission Exit Service
RT11	B1 – Distribution Entry Service
TRT2	B2 – Transmission Entry Service
RT12	C1 – Time of Use (Residential) Bidirectional Service