TasNetworks Customer Connection Forecasts

2015

Action	Name and title	Date
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1 Introduction

To assist in the budgeting and planning process for future programs of work, TasNetworks requires forecasts of the number of new network connections extending for a period from 2014-15 to 2023-24. In the past Aurora Energy has engaged ACIL Tasman (ACIL) to conduct the forecasts for complex customers. For the latest round of forecasts TasNetworks has developed the forecasting models in house. A table of the complex connection forecasts provided in this report and the work category on which the data is based is provided in Table 1. Work categories to be used for the budget preparation for the upcoming distribution determination are also included in Table 1.

Table 1 Forecasts presented in this report

Forecast	Work Category Base Data	Work Category – Budget Preparation
New residential connections	SOPOC, SOPOR, SUPOR	CNMAR
New commercial connections	SOGSC, SOGSI, SUGSI	CNMAC
New irrigation connections	SOIRC, SOIRR	CNMAI
New residential subdivisions (lots)	SOSDC, SOSDI, SUSBD	CSUDN

The following category codes contained low volumes of data and have not been included in new customer connections forecasts: SOLCP, SOLCI, SUMPR, SUSCA and SUSUB. Although these work categories contain unreliable volume information, the expenditure information is reliable and is accounted for during the budget preparation process.

For each of these customer classes more information is provided in the report regarding treatment of the forecasts across three service regions:

- North West
- North
- South

In addition, further information is available regarding the split between overhead and underground connections for new residential and commercial customer connections.

This report also contains forecasts for basic connections and embedded generation connections which fall outside the scope of the complex connections mentioned above.

It is also worth noting that Aurora Energy had a major change in customer connections policy at the end of financial year 11/12 which resulted in an increase in costs for customers wanting to connect to the distribution network. It is expected that this had an impact on the volume of new customer connections but the full extent of this impact is difficult to quantify due to the general decline in new connections caused by the declining economic environment in Tasmania at the time.

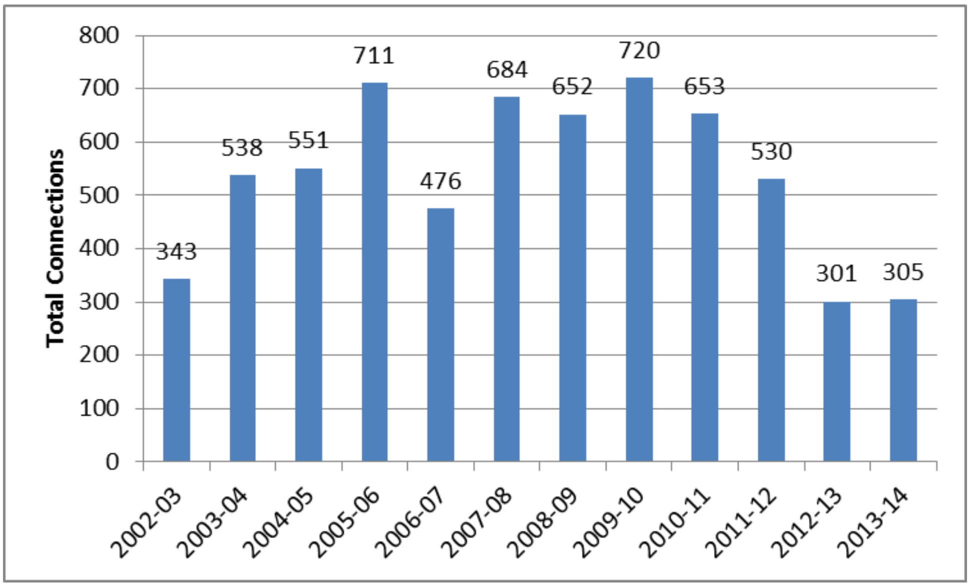
The report is structured as follows. Section 2 describes the historical information of each customer class to be forecast. Section 3 examines the methodology to be implemented in the forecasting process, Section 4 examines basic customer connections, Section 5 discusses the validity of embedded generation connections data and Section 6 presents the forecast results. Appendix A presents the statistical results of linear regression modelling and Appendix B presents the back casting of the complex customer connection models.

2 New Complex Customer Connections

2.1 Residential Connections

The number of new residential connections in each financial year from 2002-03 to 2013-14 for the whole of Tasmania are shown in Figure 1 below.

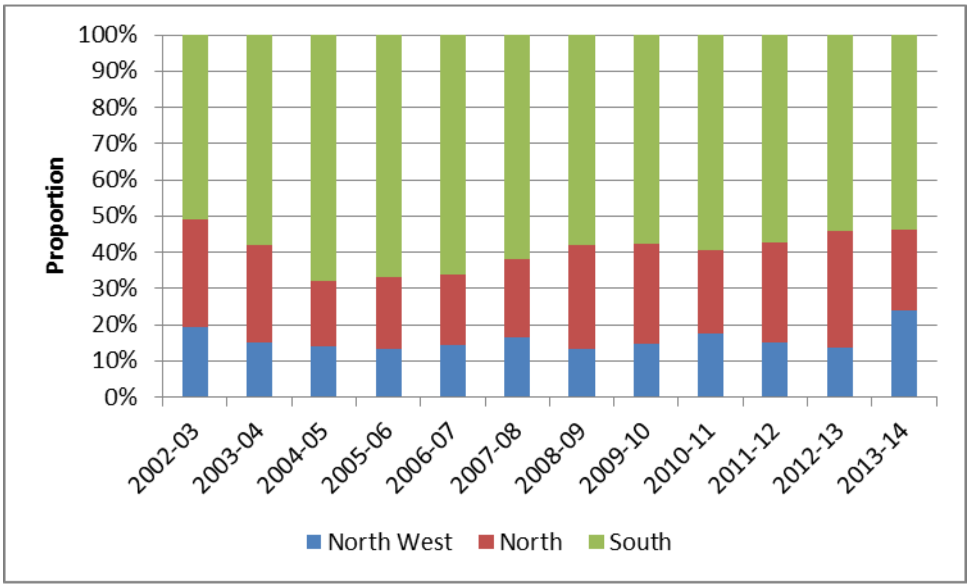
Figure 1: New residential connections



The period of growth between 2002-03 and 2005-06 was halted by a low year in 2006-07. From 2007-08 through to 2010-11 the new residential connections remained steady in the region of the end of the growth period. A decline in new residential connections has been seen in the recent data from 2011-12 to 2013-14 and is likely caused by the declining economic environment in Tasmania. The Tasmanian economic environment is discussed further in Section 3.1. Preliminary data for the 2014/15 year is presented in Section 4.

The proportional split of new residential connections presented in Figure 1 between three areas of the state is presented in Figure 2 below.

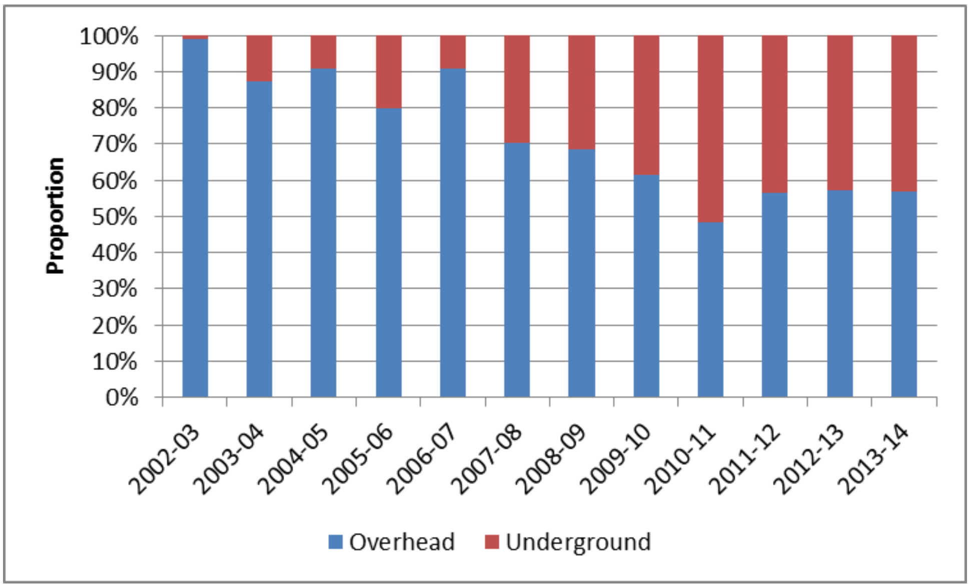
Figure 2: Proportion of new residential connections by region



The proportion of new residential connections around the state remains relatively steady in the past. During the middle years presented the south of the state had a higher than usual share of the connections but this has since settled down to the 50%-60% range. The North and North West typically contain 15%-25% of the new residential connections each.

The state wide split of connection type is presented in Figure 3 below.

Figure 3: Proportion of new residential connections by type

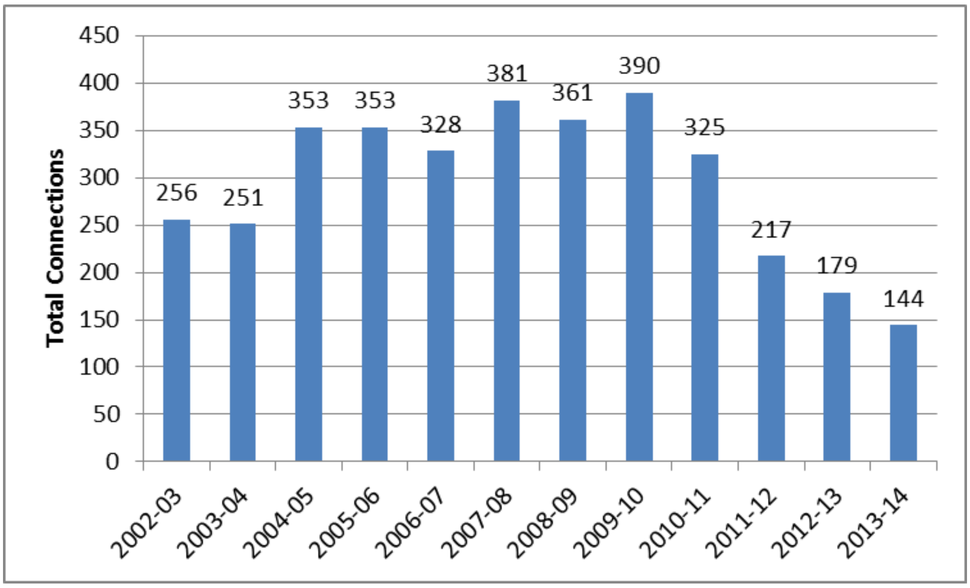


During the early and middle years there was an increasing trend toward underground connections rather than overhead connections. This has settled down in recent years to around a 45% to 55% split with overhead connections more prevalent.

2.2 Commercial Connections

The number of new commercial connections in each financial year from 2002-03 to 2013-14 for the whole of Tasmania are shown in Figure 4 below.

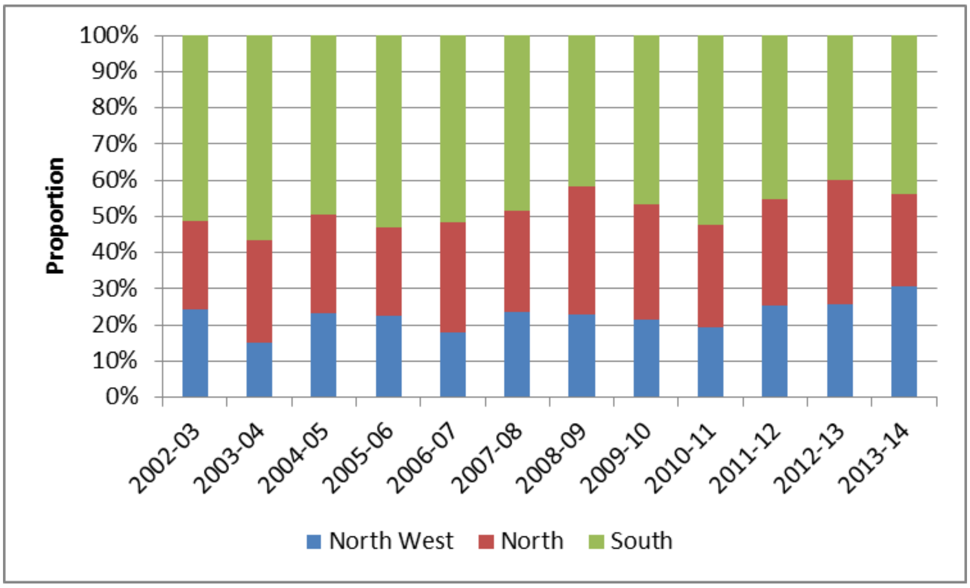
Figure 4: New commercial connections



A step jump in commercial connections was seen in 2004-05 and sustained with slight growth until 2009-10. From 2010-11 onward there has been a rapid decline in new commercial connections likely caused by the declining economic environment in Tasmania. The Tasmanian economic environment is discussed further in Section 3.1. Preliminary data for the 2014/15 year is presented in Section 4.

The proportional split of new commercial connections presented in Figure 4 between three areas of the state is presented in Figure 5 below.

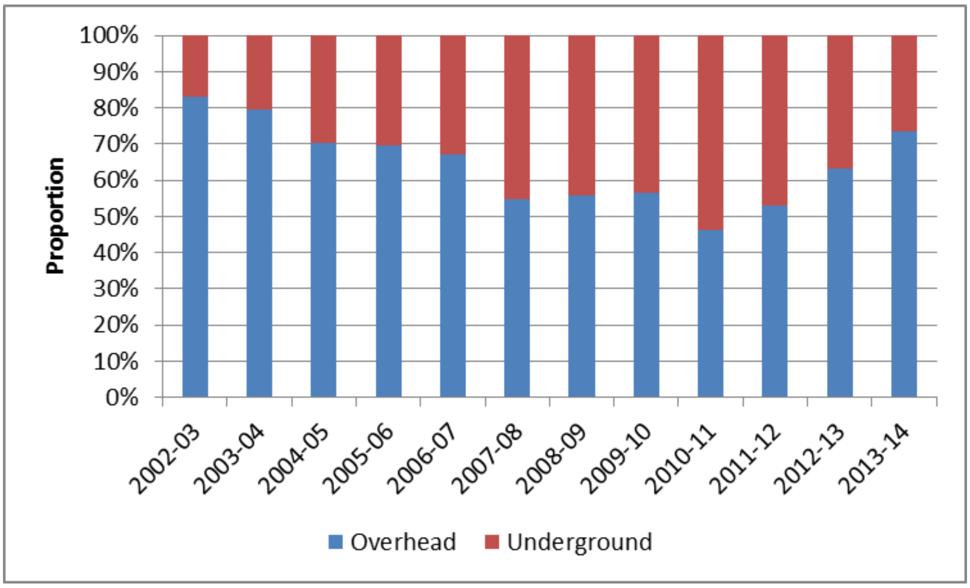
Figure 5: Proportion of new commercial connections by region



The proportion of new commercial connections around the state remains relatively steady in the past. In recent years the south of the state has had a lower than usual share of the connections at 40%-45%. The North and North West typically contain 15%-25% of the new commercial connections each.

The state wide split of connection type is presented in Figure 6 below.

Figure 6: Proportion of commercial connections by type

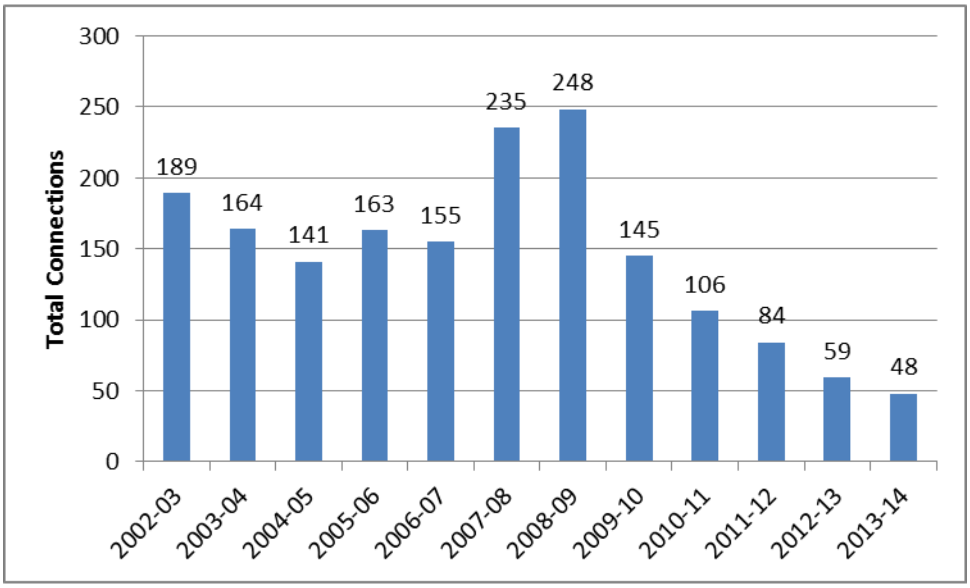


During the early and middle years there was an increasing trend toward underground connections rather than overhead connections. This has reversed in recent years and currently sits at a 25% to 75% split with overhead connections more prevalent.

2.3 Irrigation Connections

The number of new irrigation connections in each financial year from 2002-03 to 2013-14 for the whole of Tasmania are shown in Figure 7 below.

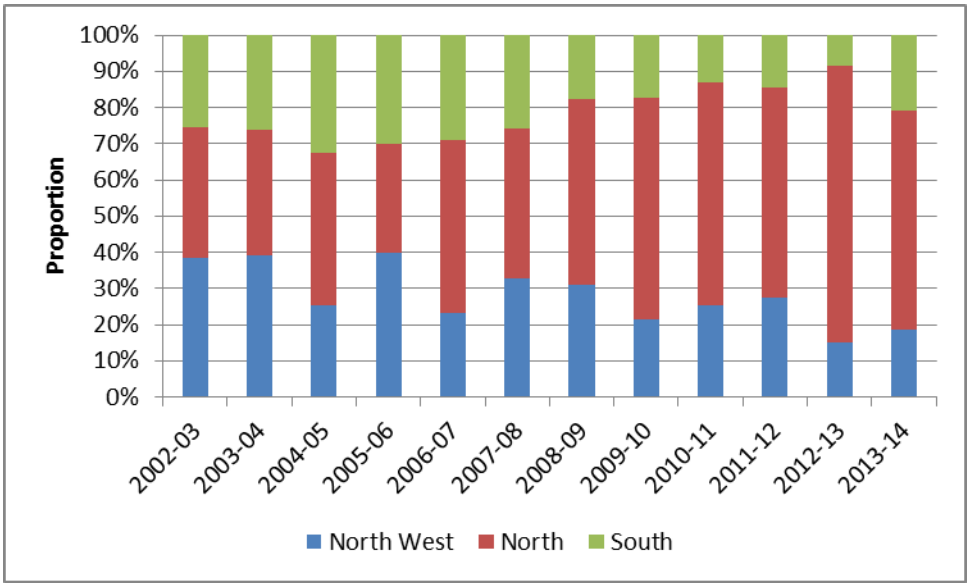
Figure 7: New irrigation connections



New irrigation connections were in a slow decline from 2002-03 to 2006-07. In 2007-08 and 2008-09 a jump in new irrigation connections was seen. Following this jump the steady decline was resumed at the previous levels. Current irrigations schemes in place do not appear to be having an impact on new irrigation connections. Preliminary data for the 2014/15 year is presented in Section 4.

The proportional split of new irrigation connections presented in Figure 7 between three areas of the state is presented in Figure 8 below.

Figure 8: Proportion of new irrigation connections by region

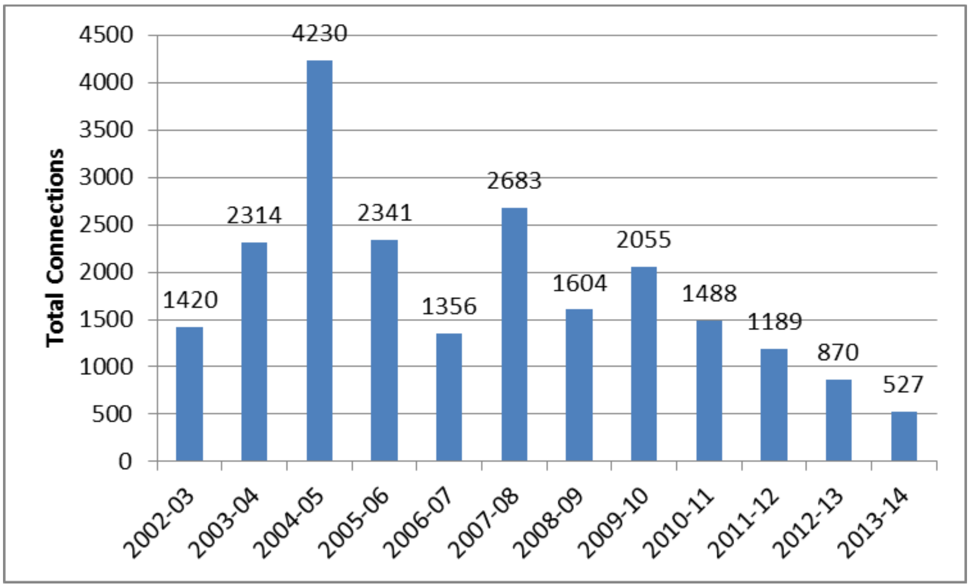


The proportion of new irrigation connections has been reducing in the North West and South and increasing in the North. This suggests that the overall decline in new irrigation connections has impacted the North West and South more than the North. In the most recent year the split of irrigation connections was roughly 60%, 20% and 20% for the North, North West and South respectively.

2.4 Residential Subdivisions (lots)

The number of new residential subdivision (lots) in each financial year from 2002-03 to 2013-14 for the whole of Tasmania are shown in Figure 9 below.

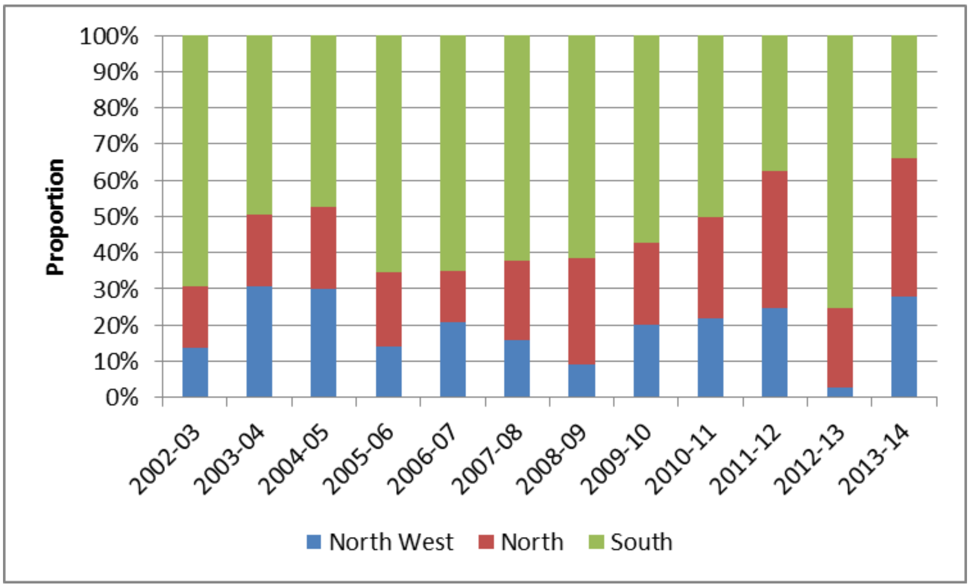
Figure 9: New residential subdivisions (lots)



The historical data for new residential subdivisions have a few outliers, particularly 2004-05. There has however been a clear pattern of decline from 2009-10 through to 2013-14 likely caused by the declining economic environment in Tasmania. The Tasmanian economic environment is discussed further in Section 3.1. Preliminary data for the 2014/15 year is presented in Section 4.

The proportional split of new residential subdivision connections presented in Figure 9 between three areas of the state is presented in Figure 10 below.

Figure 10: Proportion of new residential subdivisions by region



In the past the south has had a 50%-70% share of the new residential subdivisions in the state. The most recent year of data shows an even 33% split across all regions.

3 Forecasting Methodology

TasNetworks has opted to apply an econometric methodology to forecast new customer connections to the distribution network. This approach requires the estimation and testing of statistical relationships between the number of new connections and the underlying drivers that influence the number of new connections.

3.1 Potential Explanatory Variables

For the previous new customer connections forecast ACIL established that building activity was the most appropriate measure of explanatory variable for new residential and commercial connections. The data used for this analysis are the Australian Bureau of Statistics (ABS) Building Approvals series (Catalogue number 8731.0) and Building Activity series (Catalogue number 8752.0).

The number of residential dwelling approvals in each year from 2003-04 to 2013-14 is shown in Figure 11 below. The actual number of residential dwelling starts is shown in Figure 12 below.

Figure 11: Tasmanian dwelling units approved, ABS Catalogue 8731.0

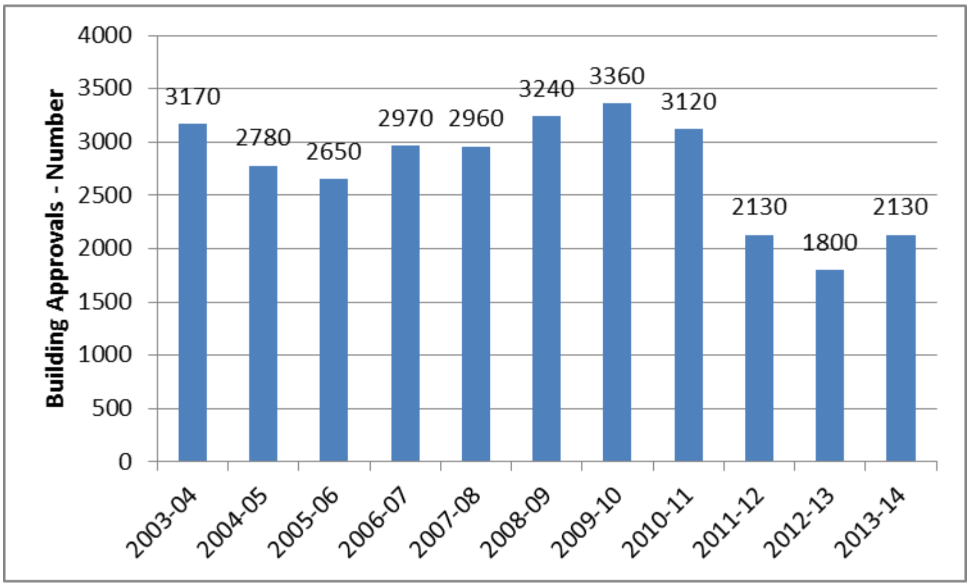
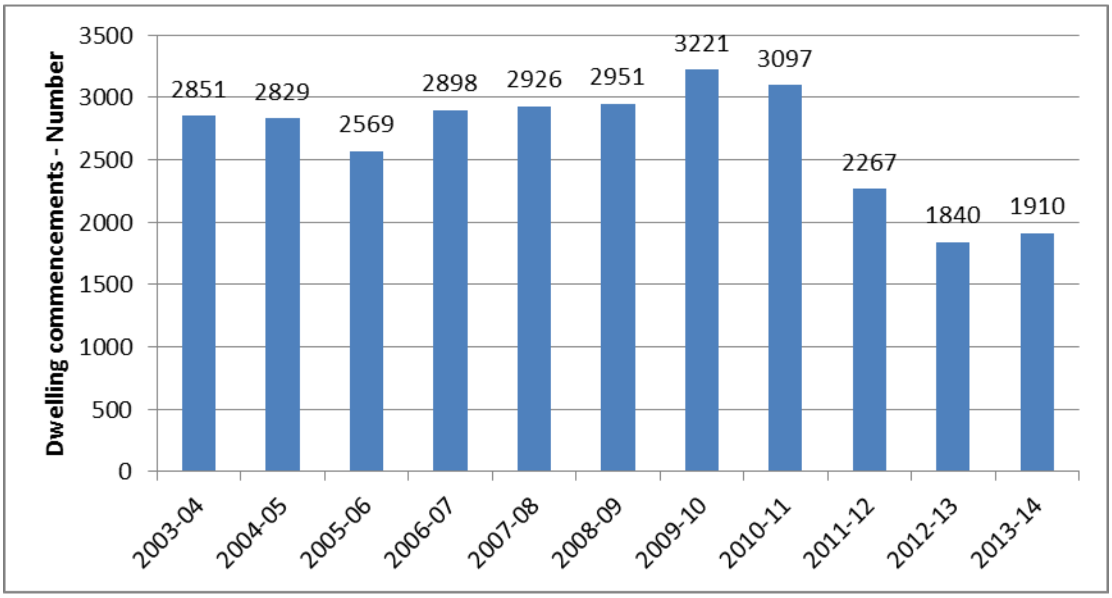


Figure 12: Tasmanian dwelling units commenced, ABS Catalogue 8752.0



In Section 2.1 we observed that a steady decline in new residential connections started in 2009-10. This observation can also be made in Figure 11 and Figure 12.

Figure 13 and Figure 14 show the value of Tasmanian residential and commercial construction respectively from 2003-04 to 2013-14.

Figure 13: Tasmanian value of residential construction, ABS Catalogue 8752.0

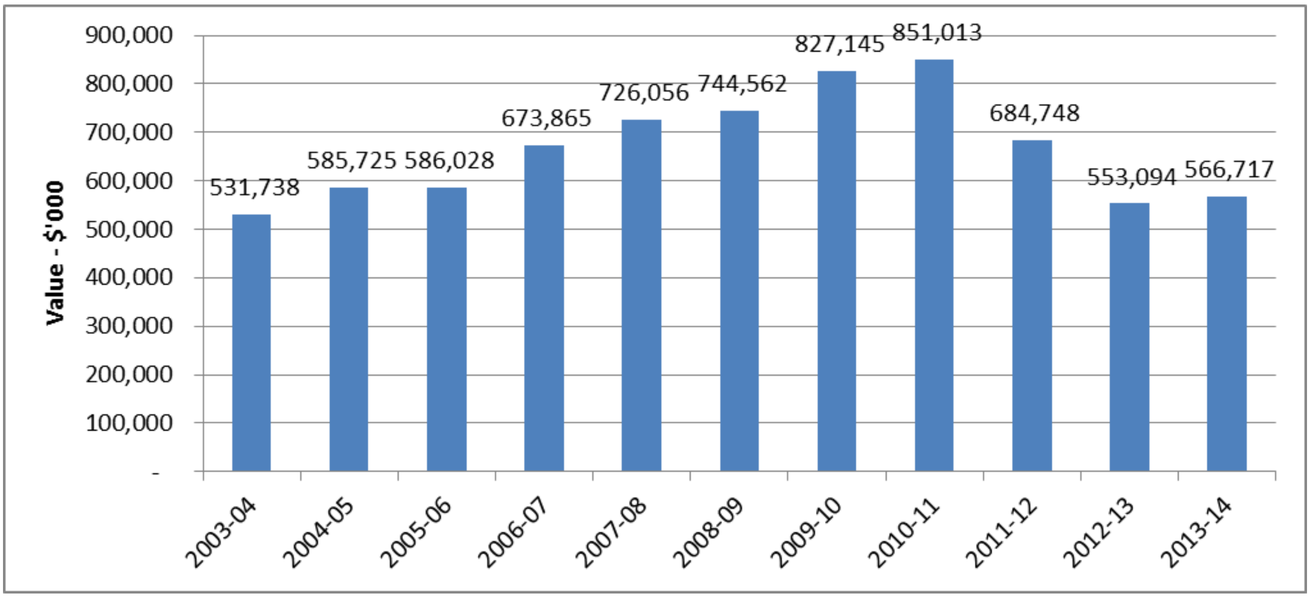
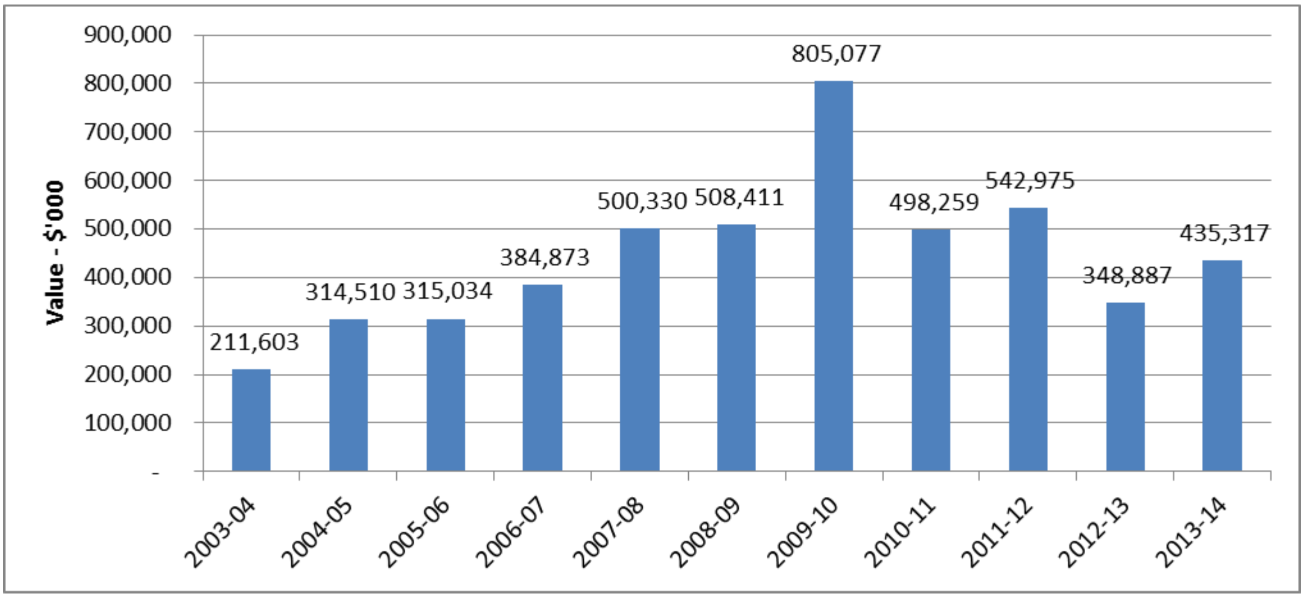


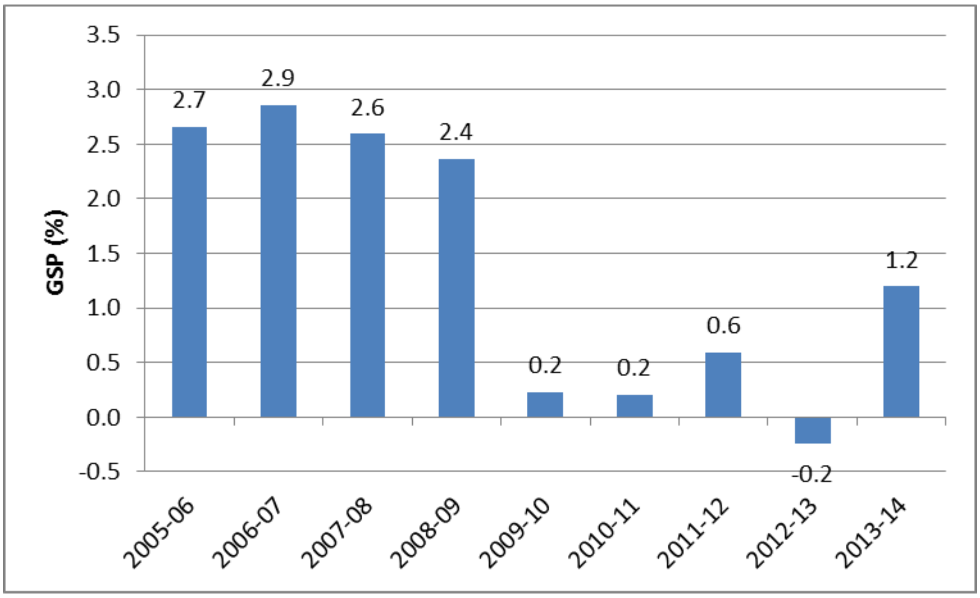
Figure 14 Tasmanian value of non-residential construction, ABS Catalogue 8752.0



The trend of decline across all customer connection categories from 2009-10 onward observed in Section 2 is also observed in the value of residential and non-residential construction data from the ABS.

In addition to examining the explanatory variables established by previous consultants, TasNetworks has also examined the role of Gross State Product (GSP) as an explanatory variable of new customer connections. Historical GSP is shown in Figure 15.

Figure 15: Gross State Product (GSP) - Tasmania



The trend of decline across all customer connection categories from 2009-10 onward observed in Section 2 is also observed in the historical GSP of Tasmania. The dramatic decline in GSP in 2009-10 relates directly to the global economic decline caused by the Global Financial Crisis (GFC).

3.2 Correlation with Explanatory Variables

To examine the relevance of the explanatory variables discussed in Section 3.1 the Pearson product-moment correlation coefficient was used to establish the level of correlation between the new customer connection category and the explanatory variable. Using the sample data available the correlation is calculated with the following mathematical formula.

$$Correl(X,Y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2(y-\bar{y})^2}}$$

Where *X* is the dependent variable (GSP or ABS data), *Y* is the associated customer category (residential, commercial, irrigation or residential subdivisions (lots)), *x* is the sample data point for the dependent variable, $\bar{x}$ is the sample average, *y* is the sample data point for the customer category, $\bar{y}$ is the average across the customer category. A resulting correlation above 0.5 is regarded as a positive correlation.

In addition to testing correlation with GSP, correlation with the moving average of GSP with a one year lag was also explored. The moving average of GSP (4 year moving average) was explored in order to smooth out the often volatile year on year GSP outcomes. The lag of GSP data was explored after considering the delay between state economic performance and the flow on effect to building activity in the state.

The results of correlation testing of explanatory variables are given in Table 2 below.

Table 2: Sample correlation coefficient of explanatory variables

Explanatory Variable	Residential	Commercial	Irrigation	Residential Subdivisions (lots)
GSP	0.31	0.46	0.71	0.47
GSP with lag (2 years)	0.84	0.95	0.83	0.86
GSP with lag (3 years)	0.97	0.89	0.72	0.90
Moving Average GSP with lag (1 year)	**0.94**	**0.99**	**0.89**	**0.92**
ABS Building Approvals	0.75	0.80	N/A	0.44
ABS Dwellings Commenced	0.82	N/A	N/A	0.52
ABS Value of Residential Construction	0.62	N/A	N/A	-0.06*
ABS Value of Commercial Construction	N/A	0.32	N/A	N/A

* Values around 0 indicate statistical independence between two variables

The building activity data used previously by ACIL for the basis of customer connections forecasts has positive correlation across most categories. It should be noted that building activity data was not previously used to for new irrigation connection forecasts. Residential and commercial categories are well correlated with the building approvals data but the residential subdivisions are just on the threshold of positive correlation when compared with the dwelling commencement data.

The results for correlation with GSP are more promising. Correlation with GSP is not positive, however correlation with a 2 or 3 year lag in GSP is strongly positive across all categories. It can be observed that the commercial and irrigation categories respond faster (2 years) to movement in GSP than the residential categories (3 years).

In the interests of creating a model consistent across all categories it was decided that the most appropriate measure was the one year lag of the 4 year moving average of GSP. It is believed this reflects adequately the delay in the construction industry response to the prevailing economic conditions as well as the response to the trend in economic conditions rather than the economic conditions that exist at any point in time.

3.3 Forecasts of Explanatory Variables

In the past, forecasts from the Housing Industry Association (HIA) and the Construction Forecasting Council (CFC) have been utilised in the forecasting of new customer connections. To support the findings of Section 3.2 these forecasts were examined again in the preparation of the latest customer connections forecasts and can be seen in Figure 16 and Figure 17.

Figure 16: HIA forecasts of Tasmanian dwelling starts

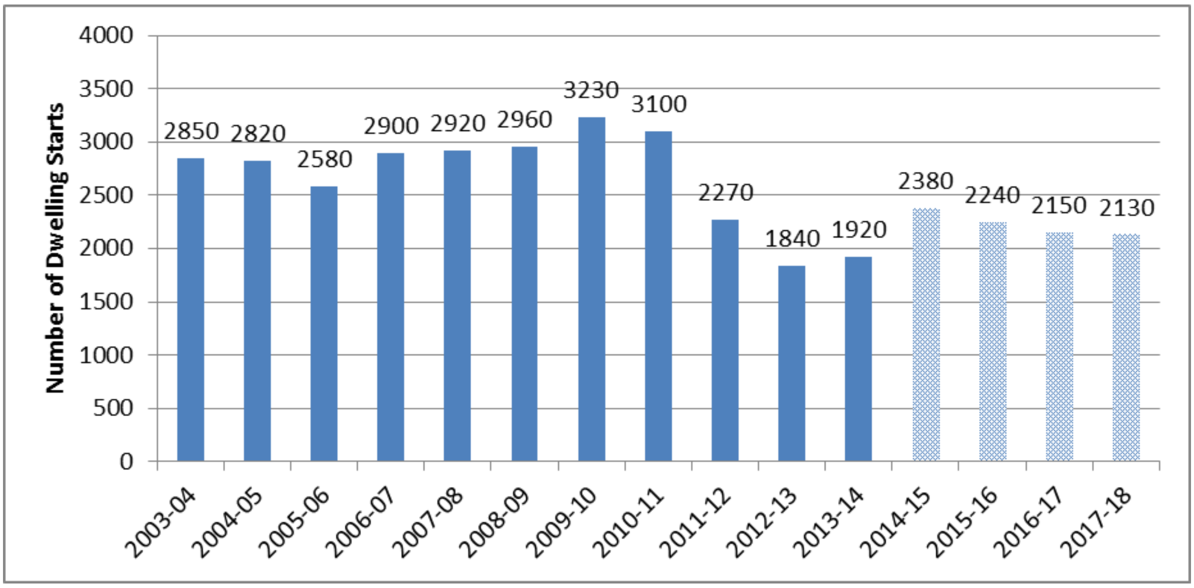
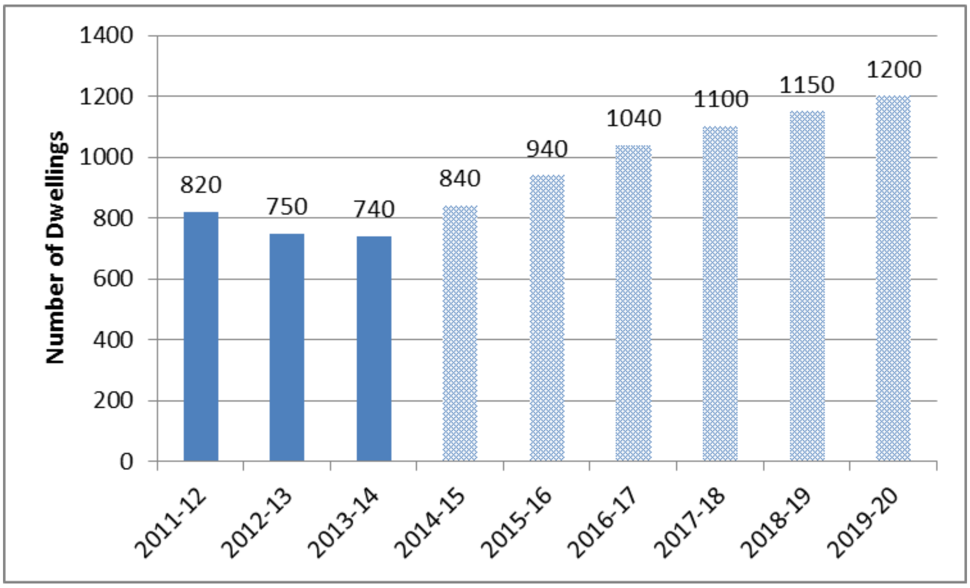


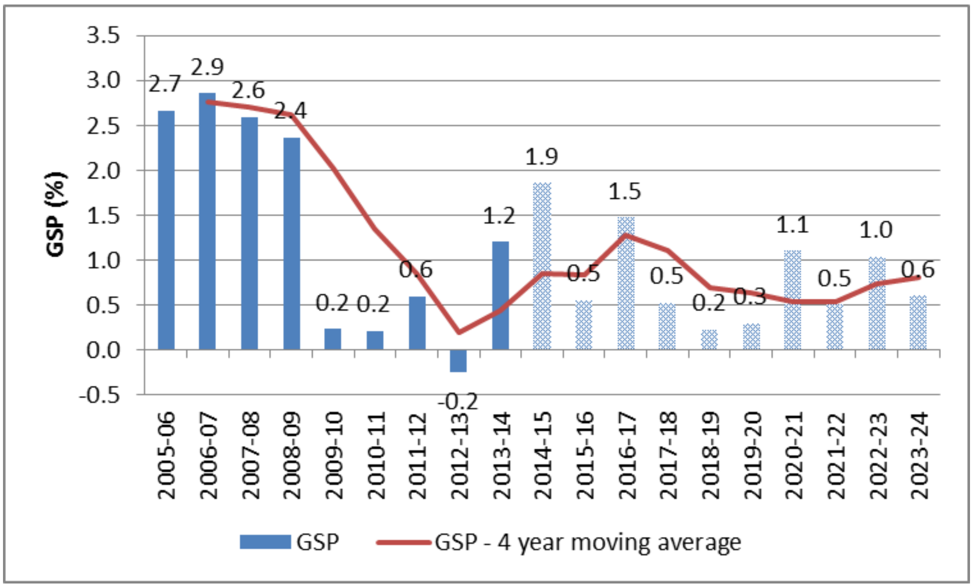
Figure 17: Construction forecasting council - Forecast of Tasmanian dwelling supply



Observing the general trend of each forecast we can see that the two forecasts do not agree. The HIA forecast shows growth in the first year followed by three years of decline whereas the CFC forecast shows continued growth for the next six years. Given that the industry appears conflicted about future growth, it is confirmed that GSP is the best explanatory variable to use for the forecasting of new customer connections.

The GSP forecast and 4 year moving average is shown in Figure 18 below.

Figure 18: Forecast of Gross State Product - Tasmania



The GSP forecast presented in Figure 18 is produced by the National Institute of Economic and Industry Research (NIEIR) as part of the annual load forecasting process undertaken by TasNetworks.

Tasmanian GSP growth is forecast to average 1.0 per cent per annum over the 2013-14 to 2018-19 period. This is well below the actual recorded GSP growth rate of 14 per cent over the last 10 years, 2003-04 to 2013-14.

High and low GSP forecasts have also been supplied by NIEIR. These are used to display high and low scenarios for the forecast outputs in Section 4.

4 Basic Connections

In addition to the complex customer connection forecasts presented above there is a business requirement to produce similar forecasts for new basic connections. These jobs cover connections where no upstream network augmentation is required except basic low voltage work to connect a new customer. In following the methodology and analysis of complex connections (see Section 3.2), correlation with GSP has been analysed for both residential and commercial basic connections.

Table 3: Sample correlation coefficient of explanatory variables

Explanatory Variable	Basic Residential	Basic Commercial
GSP	0.07*	0.42
Moving Average GSP	0.71	0.76
Moving Average GSP with lag (1 year)	**0.72**	**0.73**

* Values around 0 indicate statistical independence between two variables

As is the case with complex connections, a correlation with raw GSP outcomes is not found although there is almost a positive correlation in basic commercial connections (correlation over 0.5). The correlation with both categories of basic connections becomes evident when comparing to a moving average of the GSP outcome. In the interests of consistency with the forecast of complex connections, the 1 year lag of moving average GSP has been chosen for the basis of the linear regression of basic residential and commercial customers. The correlation outcomes between using the 1 year lag and not using it is immaterial with basic residential connections improving by 0.01 and basic commercial connections reducing by 0.03.

It should be noted that the correlation outcomes are not as strong as complex connections. This is a direct result of the low cost of connection compared to complex connections. With complex connections the customer bares some of the cost of network augmentation and as a result will only proceed with the connection if the prevailing economic environment is positive.

5 Embedded Generation Connections

In addition to the complex customer connection forecasts presented above there is a business requirement to produce similar forecasts for new basic embedded generation connections. In this instance the embedded generation connections are predominantly household solar connections.

A correlation analysis of solar connections to GSP shows a strongly negative correlation, indicating that when the state economic performance is good, less solar connections will occur and vice versa. This result is counterintuitive and is incorrect for a number of reasons given below:

- Household solar is an emerging market and is quickly building from a low install base at a time when economic performance of Tasmania has trended in the opposite direction.
- Household solar connections experienced a major increase in volume at the same time that the Tasmanian Government announced that the feed in tariff for solar would be changed[1]. This created a large external stimulus to the solar industry which is independent of most affordability criteria.
- It is counterintuitive to suggest that when people are in a less affluent environment they will choose to invest in household solar generation to a higher degree than when they find themselves in a more affluent environment.

For these reasons it is concluded that household solar connections are independent of the GSP for Tasmania. It is unlikely that any available variable will reliably assist in the creation of a forecasting model for embedded generation. The upcoming introduction of household battery storage products in January 2016 will have an unknown impact on the solar generation market and will introduce a great many unknowns in the forecasting of these connections. For this reason it was decided that a statistical average of historical connection volumes would be the most appropriate way of forecasting future solar connections. The connection volumes from financial years 12/13 and 13/14 have been excluded from the average calculation as these volumes were heavily distorted from the grandfathering of the feed in tariff.

Further analyses of connections will take place in the future to ensure the averaging of historical connection volumes remains the best approach.

[1] http://www.energyregulator.tas.gov.au/domino/otter.nsf/elect-v/30

6 Forecasts of New Connections

Output from the estimated statistical models which form the basis of the forecasts is presented in the Appendix A.

For each forecast presented, the moving average of the GSP as described in Section 3.2 was used as the explanatory variable.

For each forecast presented the 2014-15 year is comprised of eight months of actual data and 4 months of estimated data. The estimated data assumes that the known eight months of the year represents the same proportion (67%) of annual data.

6.1 Total Complex Connections

6.1.1 Complex Connection Forecasts by Customer Class

Forecasts for the total number of new complex connections across the whole network by customer type shown in

Table 4.

The forecasts are also presented graphically in the four figures that follow. In general it is anticipated that growth will be experienced across all customer types until 2017-18. Following this time the economic conditions in Tasmania are forecast to decline somewhat, resulting in a decline in the number of new customers connecting to the network.

Table 4: Total new complex connections by customer class

Year	Residential	Commercial	Irrigation	Residential Subdivisions (lots)
2002-03	343	256	189	1420
2003-04	538	251	164	2314
2004-05	551	353	141	4230
2005-06	711	353	163	2341
2006-07	476	328	155	1356
2007-08	684	381	235	2683
2008-09	652	361	248	1604
2009-10	720	390	145	2055
2010-11	653	325	106	1488
2011-12	530	217	84	1189
2012-13	301	179	59	870
2013-14	305	144	48	527
		Forecast*		
2014-15	404	126	54	434
2015-16	413	186	70	840
2016-17	411	185	69	832
2017-18	478	229	99	1122
2018-19	451	212	87	1007
2019-20	388	170	59	732
2020-21	379	163	55	689
2021-22	365	154	49	627
2022-23	364	153	48	623
2023-24	395	174	62	761
2024-25	407	182	67	812
2025-26	407	182	67	812
2026-27	422	192	74	880

* Note: Forecast for complex connections was completed before the full year of 14/15 data was available.

Figure 19: New residential connections - complex

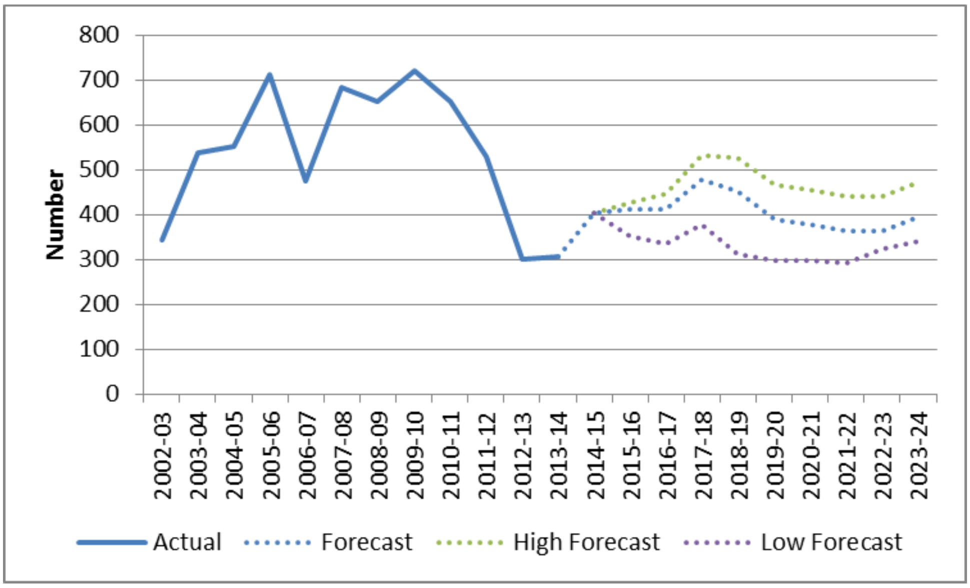


Figure 20: New commercial connections - complex

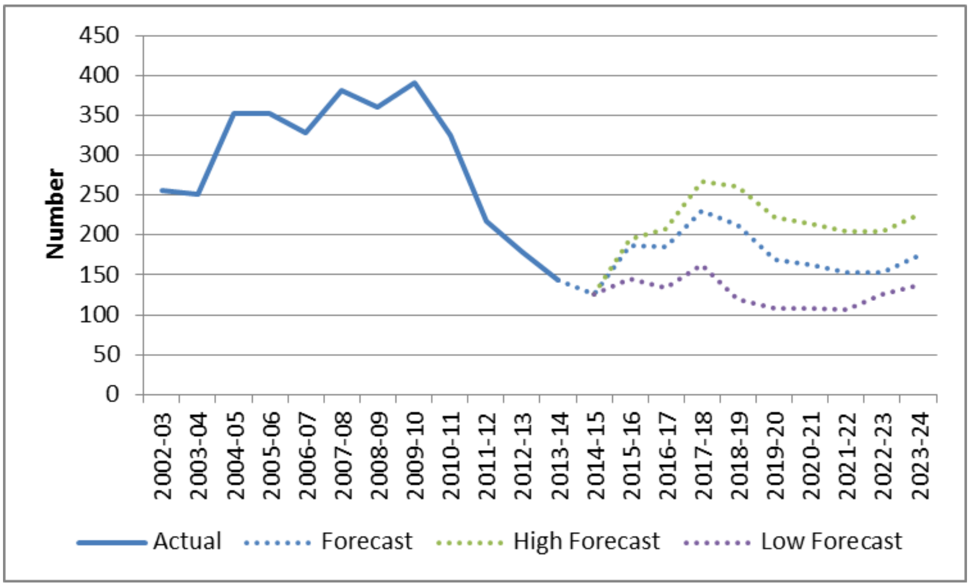


Figure 21: New irrigation connections

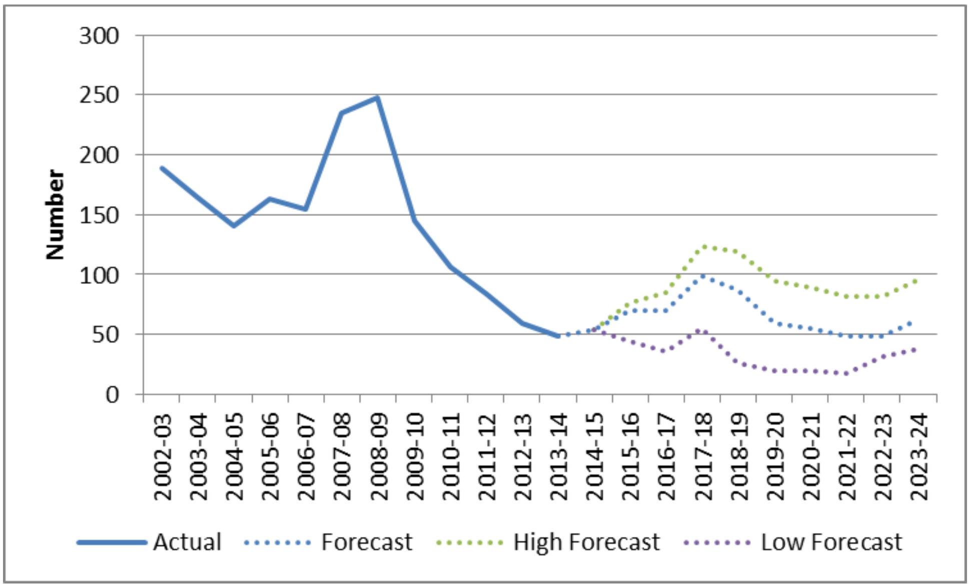
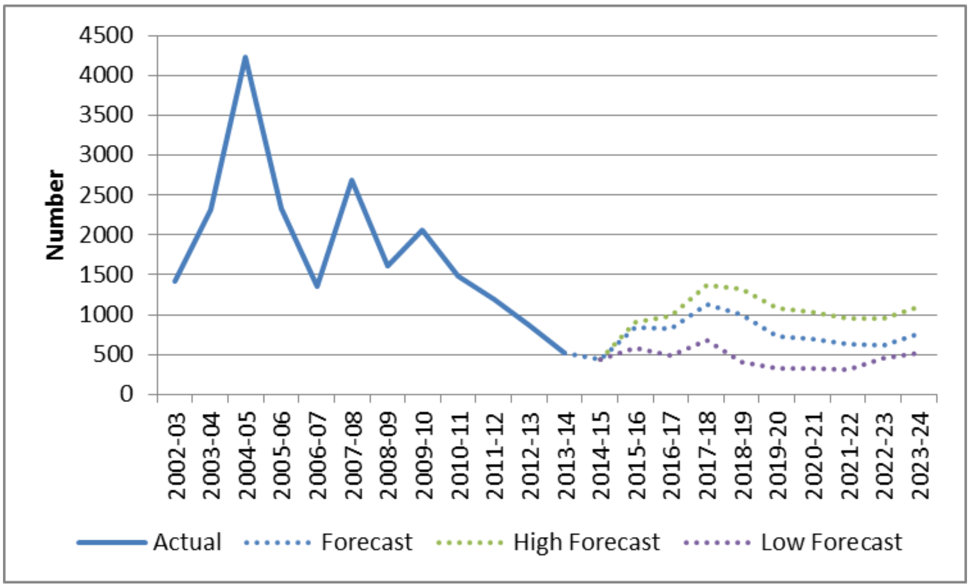


Figure 22: New residential subdivisions (lots)



6.1.2 Complex Connection Forecasts by Region

Results by region are not provided in this report. Table 5 shows the long term average proportion of total new customer connections for each region. This should be used as a guide to convert the state wide forecasts presented in Table 4 into regional forecasts. For further advice on the creation of regional forecasts please contact the TasNetworks Network Planning team.

Table 5: Long term average proportion by region

Region	Residential	Commercial	Irrigation	Residential Subdivisions (lots)
North West	16%	23%	28%	19%
North	25%	29%	50%	25%
South	59%	48%	22%	56%

6.1.3 Complex Connection Forecasts by Connection Type

Results by connection type are not provided in this report. Table 6 shows the recent trend of the proportion of total new customer connections for each connection type for each region. This should be used as a guide to convert the state wide forecasts presented in Table 4 into forecasts by connection type. For further advice on the creation of forecasts by connection type please contact the TasNetworks Network Planning team.

Table 6 Recent trend of connection type

Region	Residential		Commercial	
	OH	UG	OH	UG
North West	45%	55%	76%*	24%*
North	59%	41%	77%	23%
South	79%	21%	49%	51%
All Regions	72%	28%	64%	36%

* Long term average data presented in table, judged to be more accurate representation of future connection type for this region and customer type.

6.2 Basic Connection Forecasts

6.2.1 Basic Connection Forecasts by Customer Class

Forecasts for the total number of new basic connections across the whole network by customer type are shown in Table 7.

Table 7: Total new basic connections by customer class

Year	Residential	Commercial
2008-09	2296	902
2009-10	2568	491
2010-11	2527	527
2011-12	2137	644
2012-13	1748	360
2013-14	1653	393
2014-15	2316	317
Forecast*		
2015-16	2025	433
2016-17	2022	431
2017-18	2131	493
2018-19	2088	468
2019-20	1985	410
2020-21	1969	401
2021-22	1945	387
2022-23	1944	386
2023-24	1995	416

* Note: Forecast for basic connections was completed after the 14/15 data was available.

Figure 23 New residential connections - basic

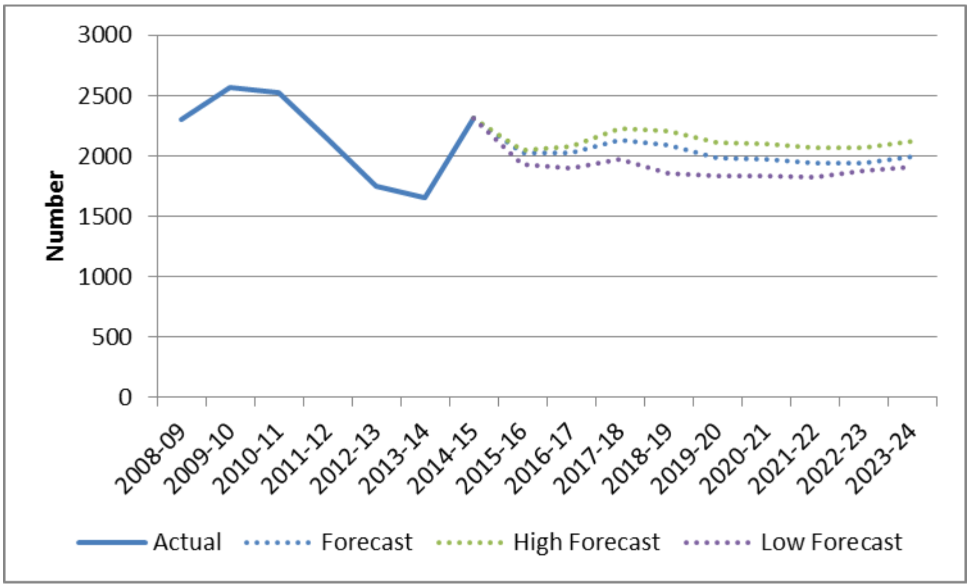
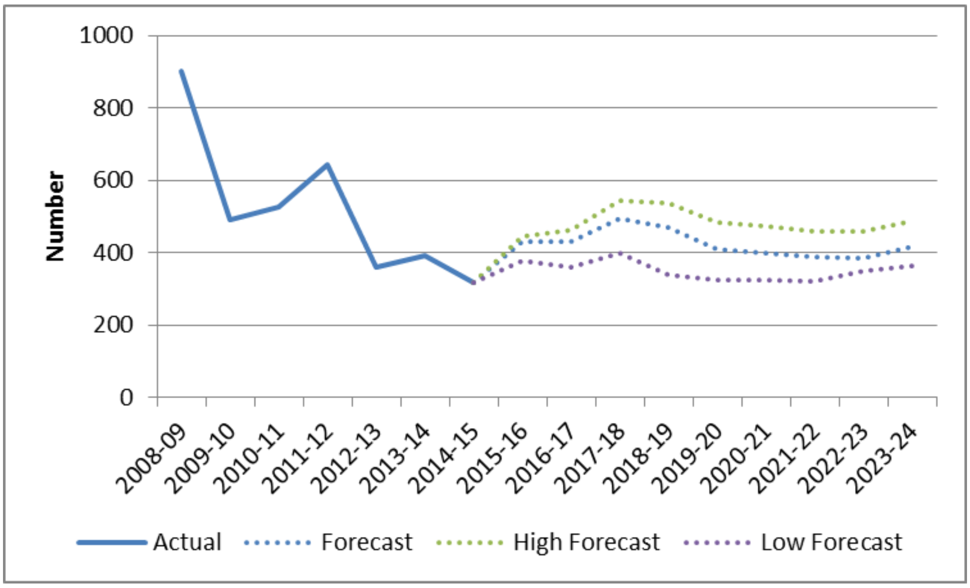


Figure 24 New commercial connections - basic



6.2.2 Basic Connection Forecasts by Connection Type

A trend analysis of recent basic residential connections suggests that 60% of new connections are underground and 40% are overhead connections.

A trend analysis of recent basic commercial connections suggests that 70% of new connections are underground and 30% are overhead connections.

6.3 Embedded Generation Forecasts

6.3.1 Embedded Generation Forecast Connections

Forecasts for new embedded generation connections across the whole network are shown in Table 8.

Table 8: Total new embedded generation connections

Year	Embedded Generation
2008-09	498
2009-10	3715
2010-11	1886
2011-12	3159
2012-13	6916
2013-14	5948
2014-15	2555
Forecast*	
2015-16	2363
2016-17	2363
2017-18	2363
2018-19	2363
2019-20	2363
2020-21	2363
2021-22	2363
2022-23	2363
2023-24	2363

* Note: Forecast for basic connections was completed after the 14/15 data was available.

6.3.2 Embedded Generation Forecasts by Connection Type

A trend analysis of recent embedded generation connections suggests that 70% of new connections are underground and 30% are overhead connections.

Appendix A - Statistical output from estimated models

Table 9: New residential connections model

Regression Statistics	
Multiple R	0.94
R Square	0.88
Adjusted R Square	0.86
Standard Error	64.14
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	184205.13	184205.13	44.78	0.000540205
Residual	6	24683.08	4113.85		
Total	7	208888.22			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	281.90	43.60	6.47	0.0006	175.22	388.58
Moving Avg GSP	154.34	23.07	6.69	0.0005	97.90	210.78

Table 10 New commercial connections model

Regression Statistics	
Multiple R	0.99
R Square	0.97
Adjusted R Square	0.97
Standard Error	20.48
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	83040.33	83040.33	197.91	8.05105E-06
Residual	6	2517.54	419.59		
Total	7	85557.88			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	98.08	13.92	7.04	0.0004	64.01	132.15
Moving Avg GSP	103.63	7.37	14.07	0.0000	85.60	121.65

Table 11: New irrigation connections model

Regression Statistics	
Multiple R	0.89
R Square	0.80
Adjusted R Square	0.77
Standard Error	38.70
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	35955.23	35955.23	24.01	0.002712066
Residual	6	8986.64	1497.77		
Total	7	44941.88			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	12.29	26.31	0.47	0.6568	-52.08	76.66
Moving Avg GSP	68.19	13.92	4.90	0.0027	34.13	102.24

Table 12: New residential subdivisions (lots) model

Regression Statistics	
Multiple R	0.92
R Square	0.86
Adjusted R Square	0.83
Standard Error	315.69
Observations	8

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3532826.59	3532826.59	35.45	0.001004357
Residual	6	597963.38	99660.56		
Total	7	4130789.97			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	265.00	214.59	1.23	0.2630	-260.07	790.07
Moving Avg GSP	675.92	113.53	5.95	0.0010	398.13	953.70

Table 13: New basic residential connections model

Regression Statistics	
Multiple R	0.72
R Square	0.52
Adjusted R Square	0.43
Standard Error	270.80
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	402271.77	402271.77	5.49	0.06620505
Residual	5	366665.16	73333.03		
Total	6	768936.93			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	1809.26	187.71	9.64	0.00	1326.74	2291.78
X Variable 1	254.01	108.45	2.34	0.07	-24.78	532.80

Table 14: New basic commercial connections model

Regression Statistics	
Multiple R	0.73
R Square	0.53
Adjusted R Square	0.43
Standard Error	152.12
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	129415.79	129415.79	5.59	0.064364624
Residual	5	115707.06	23141.41		
Total	6	245122.86			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	310.12	105.45	2.94	0.03	39.06	581.17
X Variable 1	144.07	60.92	2.36	0.06	-12.54	300.68

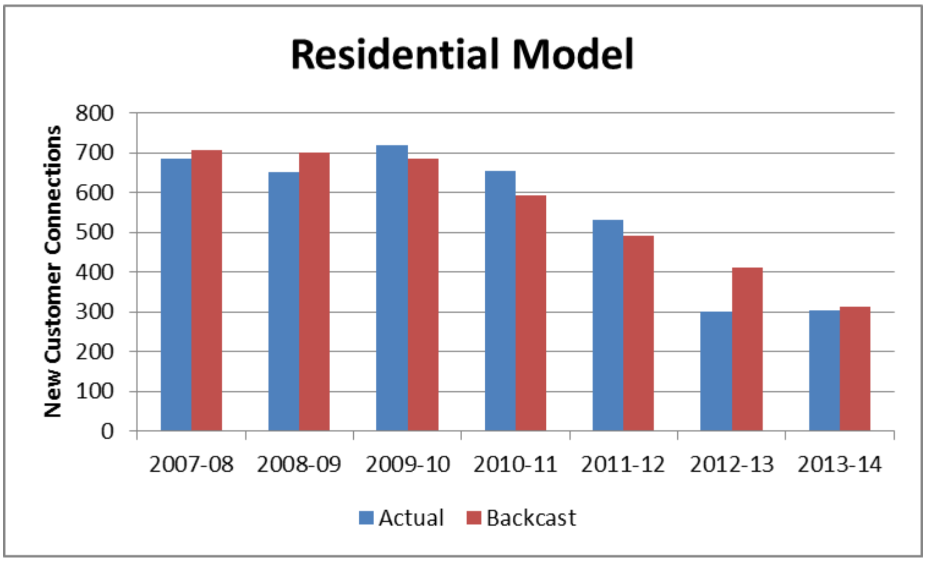
Appendix B - Backcasting results

Four models have been developed using the moving average of GSP as a predictor for complex customer connections in each of the four categories. Each of these models has been backcast to give an indication of historical accuracy. The backcasts are presented below.

Residential Model

The mean percentage error of the residential model across the 2007-08 to 2013-14 period is -4.0%.

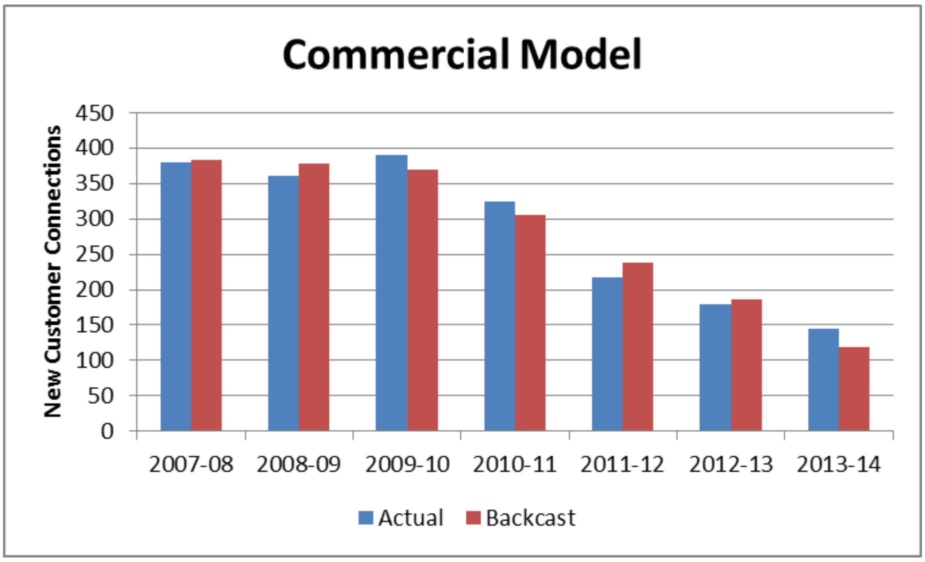
Figure 25 Residential Model Backcast



Commercial Model

The mean percentage error of the commercial model across the 2007-08 to 2013-14 period is 1.4%.

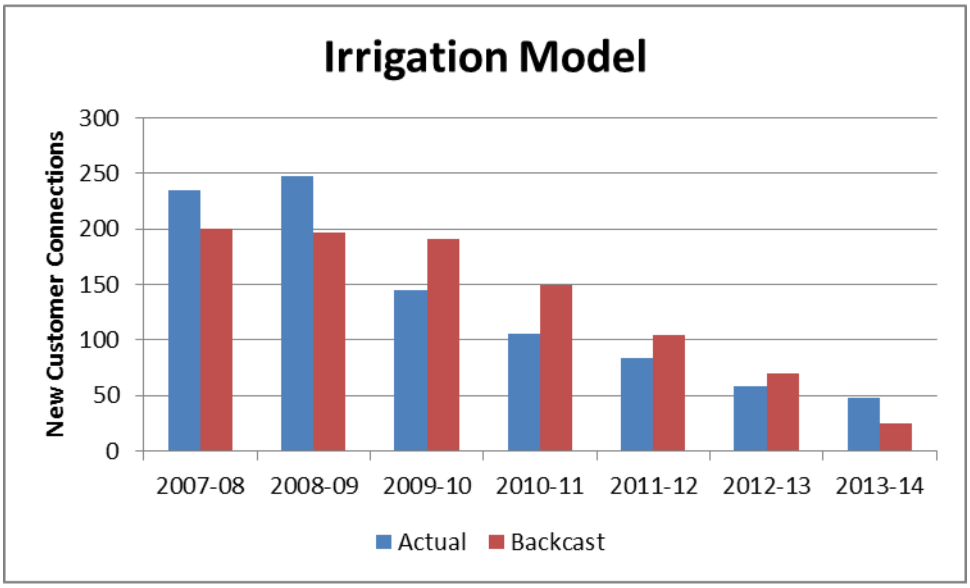
Figure 26 Commercial Model Backcast



Irrigation Model

The mean percentage error of the irrigation model across the 2007-08 to 2013-14 period is -4.7%.

Figure 27 Irrigation Model Backcast



Residential Subdivisions (lots)

The mean percentage error of the residential subdivisions (lots) model across the 2007-08 to 2013-14 period is 1.7%.

Figure 28 Residential Subdivisions (lots) Model Backcast