APPENDIX 18

Electricity consumption and maximum demand projections for the Energex region to 2025

NIEIR

Electricity consumption and maximum demand projections for the ENERGEX region to 2025

A report for
ENERGEX

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1. Introduction

The National Institute of Economic and Industry Research (NIEIR) was commissioned by ENERGEX Limited to prepare forecasts of electricity sales and demand for its distribution area. This report updates previous work completed by NIEIR for ENERGEX since 2003.

The objectives of this study were to:

- Prepare maximum demand and energy consumption forecasts for the period to 2023-24 for ENERGEX's distribution region. This is to comprise high, medium and low growth scenarios including an analysis of factors used to arrive at the differential growth rates.

  The forecasts cover:

  - energy sales by customer class; and
  - forecasts of summer and winter MDs for the 10^{th}, 50^{th} and 90^{th} percentile probabilities of exceedence. (This is consistent with the approach adopted by Powerlink for MDs.)

  The base, high and low growth scenarios have been benchmarked on different economic growth scenarios for Queensland and the ENERGEX distribution region.

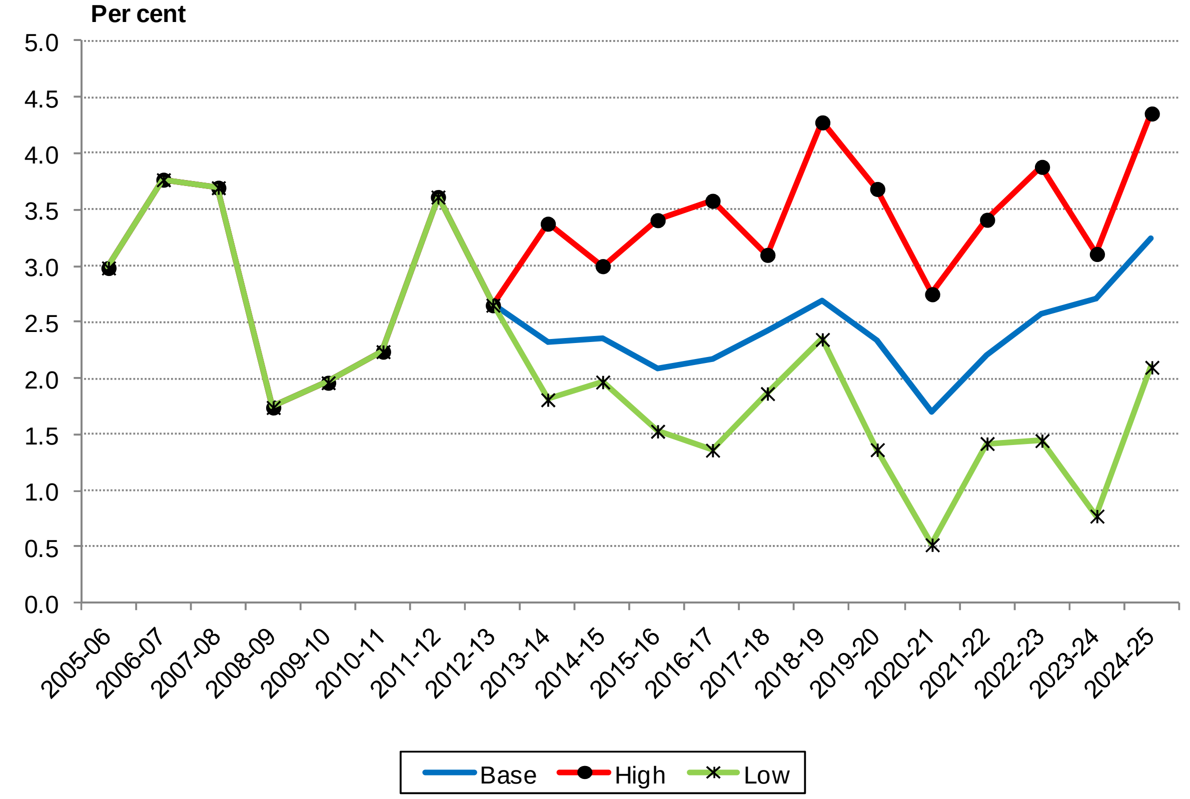
This forecast report updates a report prepared in November 2013 for ENERGEX. This report incorporates an updated economic outlook prepared in January 2014.

2. The economic outlook for Australia to 2024-25

2.1 Introduction

This section provides an outline of the economic outlook for Australia to 2024-25. Figure 2.1 shows the outlook for Australian gross domestic product to 2024-25 by scenario. Table 2.1 shows the projected annual Australian GDP growth rates to 2024-26 for each of the scenarios. These economic forecasts were prepared in February 2014.

Figure 2.1: Australian GDP growth by scenario (annual per cent change)



Note: Financial years ending June.

Table 2.1 gives span growth rates across each scenario for Australian GDP growth. Figure 2.1 shows the graphical profile for the key high, low and medium scenarios. The cyclical profiles in Figure 2.1 reflect the cycle in the world economy.

Table 2.1	Australian GDP growth under each scenario (per cent)		
Financial year	**Base**	**High**	**Low**
2005-06	3.0	3.0	3.0
2006-07	3.8	3.8	3.8
2007-08	3.7	3.7	3.7
2008-09	1.7	1.7	1.7
2009-10	2.0	2.0	2.0
2010-11	2.2	2.2	2.2
2011-12	3.6	3.6	3.6
2012-13	2.7	2.7	2.7
2013-14	2.3	3.4	1.8
2014-15	2.4	3.0	2.0
2015-16	2.1	3.4	1.5
2016-17	2.2	3.6	1.4
2017-18	2.4	3.1	1.9
2018-19	2.7	4.3	2.3
2019-20	2.3	3.7	1.4
2020-21	1.7	2.8	0.5
2021-22	2.2	3.4	1.4
2022-23	2.6	3.9	1.4
2023-24	2.7	3.1	0.8
2024-25	3.2	4.4	2.1
Compound average annual change			
2012-13 to 2024-25	2.4	3.5	1.5
2013-14 to 2018-19	2.3	3.3	1.7
2018-19 to 2024-25	2.5	3.5	1.3

2.2 The world and national outlook

2.2.1 Introduction

Compared to the previous economic projection, this updated economic outlook contains downward revisions to macroeconomic projections for the world and Australian economies.

The world economic outlook has been downgraded, which is to be expected given that a severe crisis such as the GFC will weaken growth for many years before the balance sheets and expectations are adjusted to allow for sustainable growth. The specific reason for the downgrades revolves around the increasing empirical evidence that quantitative easing policies in the developed world have given emerging and developing countries easy access to liquidity. This increased access to liquidity has driven these countries' growth rates over the last few years at the cost of increasing structural imbalances. The tapering down and eventual ending of qualitative easing policies is triggering feedback effects which are undermining the growth in the emerging economies.

In terms of the Australian economy, since the last economic outlook there has been a change in Federal Government with a different set of policies in relation to the economy in general, and industry policy in particular. This has now led to the end of motor vehicle production in Australia by 2017 and, no doubt, enterprises in other manufacturing industries will conclude that Australia is no longer a place to do business. The collapse of the motor vehicle industry, a key conduit of advanced skills and technology into the Australian economy, will undermine the competitiveness of other industries and accelerate the de-industrialisation process.

This development, in a country with a huge foreign debt, can only add to Australia's debt burden. The expectation that the country cannot repay their debts at expected levels of economic growth could trigger a crisis. In terms of Australia's economic outlook, this crisis would be a balance of payments/banking crisis.

Secondly, the new Australian Government is likely to undertake a more severe fiscal consolidation than what was previously expected over 2014-15 and into 2015-16. This will lower growth compared to the previous economic projection.

2.2.2 The world economy

The world economic outlook has been downgraded since the last economic projection. The previous outlook projected world economic growth at just under 4 per cent for 2014 and just over 4 per cent for 2015 and averaging 4.0 per cent for 2016 to 2018, before falling to 3 per cent by 2020.

The current projected outlook for 2014 is projected at 3 per cent and 3.4 per cent for 2015. However, the average annual growth rate for the four years 2015 to 2018 is now 3.5 per cent, not 4.0 per cent as projected previously.

The reasons for the downgrade are due to the recognition that the tapering down of quantitative easing in the United States is likely to have greater implications for the emerging economies than what was initially expected.

At the height of quantitative easing in the United States over 2012 and 2013, the extra liquidity resulted in large scale capital outflows from the United States into emerging economies. This replaced the liquidity to allow emerging economies to grow strongly over the past 2 to 3 years despite negligible growth in the developed world. The other important factor was Chinese growth, which drove commodity prices and the demand for resources.

With the tapering down of quantitative easing and the likely increase in effective interest rates in the United States net capital inflows back into the United States will increase sharply, triggering in effect a capital flight from emerging economies.

This is what has been happening over the last few months, especially in the "fragile Five" economies of:

- Argentina;
- Brazil;
- Indonesia;
- Turkey; and
- South Africa.

These countries have generally suffered sharp falls in their currencies over recent months and have had to raise domestic interest rates which will reduce growth.

The common factors of all countries are high external foreign debt and/or current account deficits, governance issues (Argentina and Turkey) and reliance on the Chinese driven commodity price boom. Currently Turkey's current account deficit is 7.5 per cent of GDP, South Africa 6.6 per cent and Indonesia 4.0 per cent. India in particular is at risk of a 1997 Asian type meltdown because of recent very high foreign borrowing by its corporate sector.

As quantitative easing ends in the United States, the growth prospect for the fragile five and other emerging economies is going to depend on the prospects for China. However, the Chinese growth rate has been revised down to closer to 6.0 per cent per annum over the next few years from the previous near 7 per cent per annum.

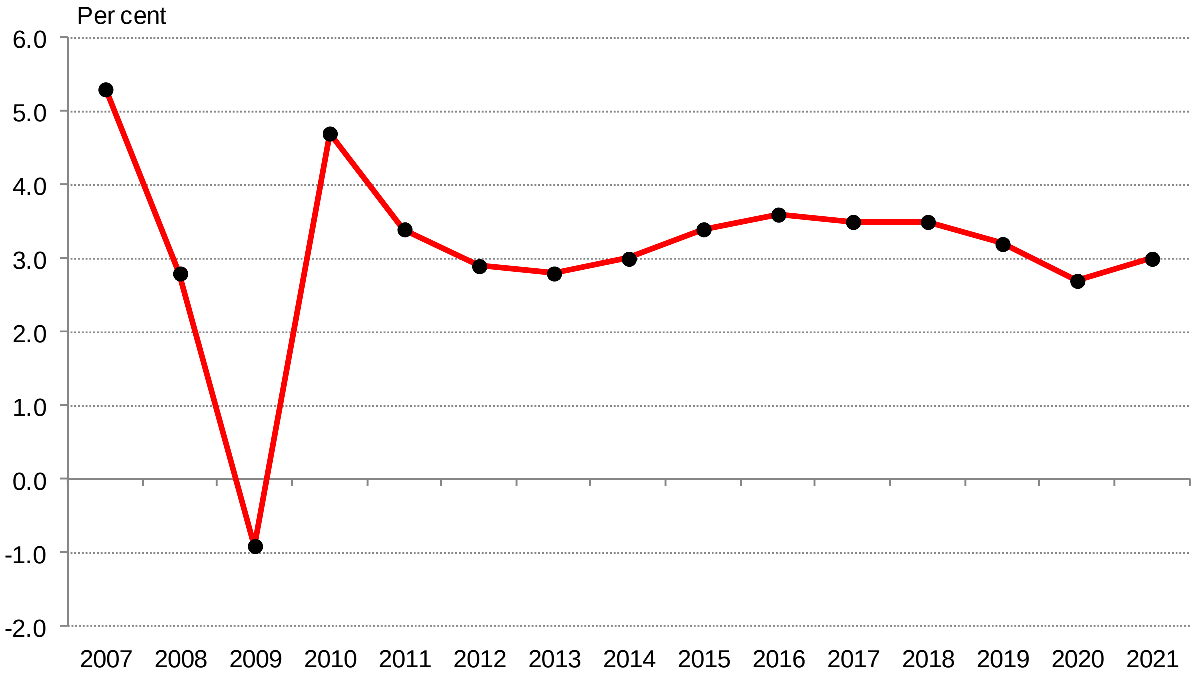
The United States is expected to grow at 3.0 per cent in 2014. It will probably disappoint with growth closer to 2.0 per cent and will struggle to do much better in the other years. The problem for the United States is that the long period of under-investment has reduced the capacity of the United States economy by 6.0 per cent, compared to the case where pre GFC trends had been maintained. This means that there is little prospect of re-employing the 4.0 per cent of the working age population that have lost employment since 2007. The long-run political implications of this are unknown.

Secondly, with the top 1.0 per cent of households by income capturing 85 to 100 per cent of the increase in pre-tax income, there is little prospect of resumption of sustainable long-run high growth. Stable sustainable long-run growth has to be driven by rapid growth in middle income households.

Growth in the Euro Area is expected to recover to between 1.5 and 2.0 per cent over the next few years.

In developed and emerging economies, only limited progress has been made recapitalising banks and developing accurate bank risk assessment. This has led some to forecast that limited progress in this area will lead to the next financial crisis. At the very least it will constrain longer term growth and constrain growth towards the end of the projection period. This has given rise to the period being named the 'era of sector stagnation'. This assessment of the world economy also best sums up the general outlook for the local Australian economy.

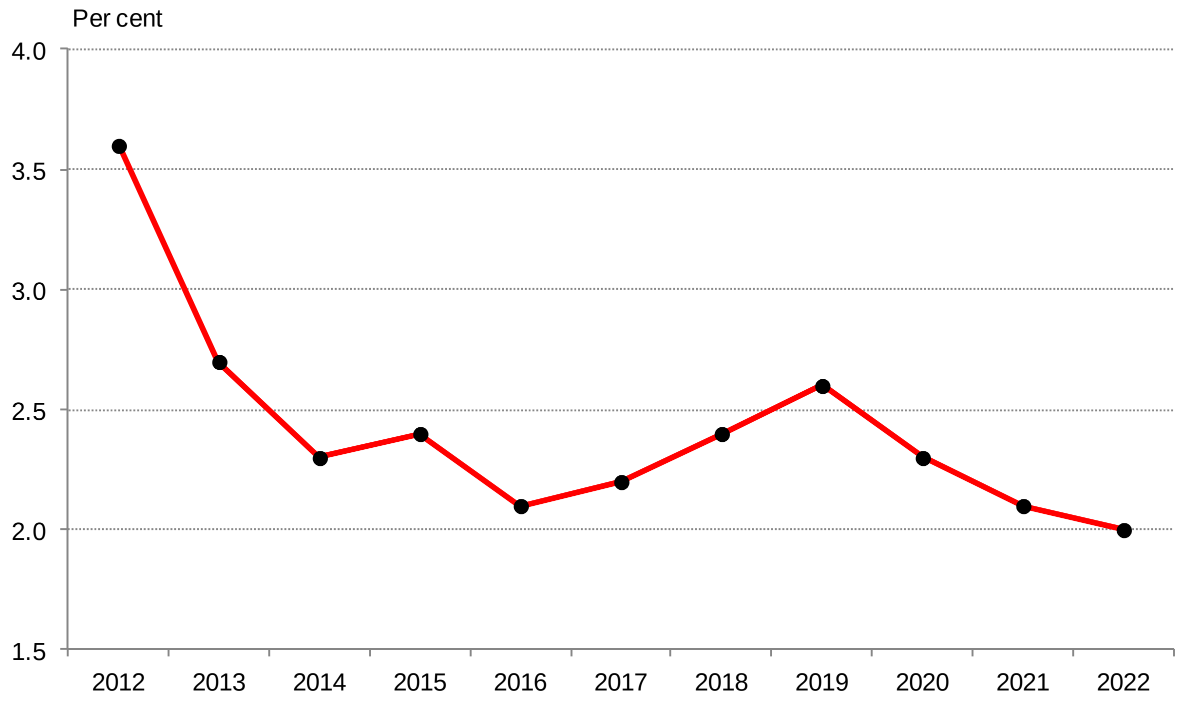
Figure 2.2: World GDP growth rate (per cent)



2.2.3 The economic outlook for Australia

The figure below shows the outlook for Australian gross domestic product growth to 2022.

Figure 2.3: Australian GDP



Note: Financial years ending June.

Gross Domestic Product

The current expectation is that GDP growth in Australia will average 2.4 per cent per annum for the 2014 and 2015 fiscal years, and 2.2 per cent for the three fiscal year period 2016 to 2018. This represents a 5.0 per cent reduction in the level of GDP now expected in 2018 compared to what was expected in the previous projection.

The reasons for the reduction in GDP growth are the following.

The reduction in world growth

As already discussed above, world economic growth has been revised down by 2.4 per cent for 2018 compared to what was previously expected. This translates into approximately a 1.0 per cent reduction in Australian GDP due to falling mining investment and the real income impact of higher commodity prices. The longer term impact of this, that is, post 2018, will be on the terms of trade and, if the world remains sluggish into the early 2020s, then at the very least a balance of payments crisis.

The contraction in manufacturing

The contraction in the motor vehicle industry multiplier effects will reduce GDP by 2.0 per cent by 2018 compared to what would have been the case if the motor vehicle industry had continued to operate at 2013 levels to 2018.

Fiscal consolidation

In the previous projection fiscal consolidation was expected. It was projected that over the years 2014 and 2015 the average contribution of public sector demand to GDP growth with flow-on multipliers would average 0.5 per cent per annum. This compares with an average growth contribution of 1.3 per cent to GDP growth from public sector demand for the four years to 2012. Over the period 2014 to 2018, the average growth contribution (with multipliers) was 0.9 per cent per annum. The current projection is for a contribution of 0.1 per cent per annum. The total reduction in GDP by 2018 is around 4.5 per cent.

Upward revisions

The total cumulative reduction from these three sources is 7.5 per cent. However, there had been some upward revisions, such as to household dwelling expenditures, which are now contributing an additional 0.8 per cent to GDP by 2016.

Table 2.2	Formation of Australian GDP (per cent)										

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Final consumption expenditure – households	2.3	3.7	2.5	2.0	2.1	2.2	2.1	2.2	2.5	3.0	2.7
Private dwellings – total	1.2	2.2	-2.2	-0.4	10.4	8.7	2.0	3.4	0.3	-7.4	-4.7
Total private equipment and construction	-3.7	7.0	17.5	4.5	-2.4	11.0	1.6	-2.2	-2.4	-2.4	-3.2
Gross fixed capital formation – private – total	-2.4	5.7	14.9	4.7	0.0	11.8	1.8	-2.5	-3.5	-2.8	-2.5
Final consumption expenditure – general government – total	1.8	3.3	3.8	0.8	1.7	1.3	0.8	1.3	2.1	2.2	2.2
New public equipment and construction investment – (excluding asset sales)	21.0	-3.3	-3.0	-8.8	3.0	-11.7	-9.6	-2.4	-3.2	3.1	-0.5
Total public demand	6.0	1.7	2.2	-1.3	2.0	-1.4	-1.2	0.7	1.2	2.3	1.8
Total final demand	2.2	3.6	5.1	1.9	1.6	3.6	1.3	0.7	0.8	1.5	1.4
Stocks and stat. discrepancy	0.0	0.5	-0.1	-0.4	-0.4	-0.1	0.1	0.1	0.5	0.4	0.5
Exports of goods and services	5.1	0.6	4.7	6.0	4.7	3.0	6.0	6.3	6.2	4.8	2.3
Imports of goods and services	6.4	10.2	11.4	0.3	-0.5	8.7	3.2	0.6	1.6	2.0	0.3
GDP	2.0	2.2	3.6	2.7	2.3	2.4	2.1	2.2	2.4	2.6	2.3

Table 2.3	Formation of Australian current account balance										

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Terms of trade	0.8	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8
Balance of trade ($m)	-12729.2	13483.0	-3487.5	-18089.5	-15917.2	-42752.7	-38248.9	-16242.4	-7882.1	1622.4	-4716.4
Current account balance ($m)	-64470.0	-42146.0	-47813.0	-55168.0	-52510.7	-82408.1	-84859.6	-70270.9	-66098.2	-66561.7	-83516.5
Current account balance – % of GDP ($m)	-5.0	-3.0	-3.2	-3.6	-3.3	-5.0	-4.9	-3.9	-3.5	-3.3	-4.0
Oil – $US a barrel	74.7	92.7	105.4	102.3	102.0	103.3	116.3	124.7	128.2	131.7	132.9
Net international debt	651050.0	659826.3	728767.5	764330.8	853998.5	950893.6	1050121.1	1134281.7	1176144.2	1274500.3	1413301.6
Net international debt (% of GDP)	50.1	46.9	49.0	50.2	53.6	57.1	60.4	62.1	62.8	64.1	67.0

2.2.4 Constraints on Australian growth

Balance of payments

Given the vulnerability of the Australian economy, the balance of payments outcome became the core element in the forecasting. The downward revision of the world economic outlook induces a downward adjustment to the terms of trade. Even so, by 2017, with the terms of trade at 0.85, with 2012 equalling 1.00, this still represents a 57 per cent increase over the terms of trade before the current mining expansion, with terms of trade of 0.58. Any further downward adjustment of the world economic outlook would have a disproportionate negative impact on the terms of trade.

As a result, the current account deficit reaches the critical threshold of 5.0 per cent of GDP over the second half of 2015 and 2016.

However, balance of payments pressures ease into 2017 and beyond due to:

(i) the export surge from major resource projects now under construction; and

(ii) sustained slow economic growth constraining imports.

The household savings ratio

A core driver of the household savings ratio is the household debt to income ratio. With the rise in the household savings ratio at the end of 2009, the household debt to income ratio has stabilised. In the December quarter 2009 the household debt to income ratio was 180 per cent of net household income. In the June quarter 2013 it was 182 per cent.

A basic assumption of the previous projection was that the recovery of dwelling prices and the flow-on impact on wealth would encourage a downward trend in the household savings ratio and, therefore, an accelerated consumption growth that would drive national GDP growth to the 3.0 to 3.5 per cent range over 2015 and 2016. Given the stability of the household debt to income ratio at current household savings ratio, this assumed that households would be willing to increase the debt to income ratio.

There is a decline in the savings ratio post 2016. However, this does not come from increasing positive expectations of the future. Indeed, the reverse is likely to be the case, since it is likely to come from the sustained downward pressure on living standards from sluggish economic growth forcing households to reduce savings. It also comes from the increasing interest rate impact on self-financed households inducing them to increase expenditures.

By 2022 the household savings ratio returns to current levels.

If a crisis occurs, then the household savings ratio will fall by 6.0 to 8.0 per cent of income, by increasing debt, reducing gross savings and the liquidation of assets. This mechanism will be important in placing a floor under the overall decline in GDP.

Employment and unemployment

The projection for employment growth is one of a little over 1.0 per cent per annum for the next 18 months, then declining to 0.8 per cent by the middle of 2016. A recovery to 1.6 per cent per annum by 2020 is forecast, before declining to 0.7 per cent by the end of the projection period. As the growth rate in employment is, in general, less the working age population growth rate, the unemployment rate steadily increases.

Until the end of 2015 there is only a modest downgrade in the number employed. The difference between the previous projection and that of this outcome is 50,000. After 2015 the difference between the two projections increases to just under 400,000 by 2017 and 450,000 by 2022.

At its peak in 2017 the difference in the number of unemployed is only 106,000. This means that the majority of the reduction in employment is offset by reductions in the labour force, either from lower migration (marginal), or the discouraged worker effect (the main adjustment), or longer periods spent in education and training.

By the end of 2016 the number unemployed reaches 900,000, or 7.0 per cent of the work force. However, if it was not for the reduction in the labour force participation rate the number unemployed would have reached 1.3 million by the end of 2016 and 1.5 million by the end of the projection period. This loss of real income and productivity will be a major direct cause of the subdued economic outlook.

The inflation rate and wages

The steady increase in the unemployment rate and the projected increase in the unused capacity capital stock rate will combine to hold the inflation rate, measured by the CPI, at moderate trend levels of approximately 2.0 per cent per annum. This outcome is assisted by only a modest reduction in the exchange rate to around 85 cents to the United States dollar. However, the fall in the currency begins to accelerate significantly after 2015, which will contribute directly to accelerating the inflation rate.

In addition, there is a limit to the extent that profit margins can be suppressed and the anti-inflation compression of profit margins will weaken even if capacity utilisation rates continue to fall. In addition, once the exchange rate begins to fall significantly, profit margins can be expected to increase significantly in trade exposed industries.

Thus, from 2016 onwards the inflation rate is projected to increase steadily, reaching 3.5 per cent on a sustained basis by the end of the projection period.

This profile would change radically if an El Nino induced drought directly increased the inflation rate to 3.5 per cent by the end of 2015 and, as a consequence of the exchange rate, fall much more sharply with the final inflation rate going above 4.0 per cent in 2016.

Interest rates

The weakening of the balance of payments over 2015 and 2016 is projected to place upward pressure on interest rates as the Reserve Bank of Australia (RBA) tries to control the downward movement of the currency and, therefore, control the inflation pressures. Upward pressure on interest rates will also stem from the policy objectives of ensuring the current recovery in the housing market is not translated into an unsustainable bubble.

Even so, the upswing in interest rates is modest, with the 90 day bill rate reaching 4.0 per cent by the end of 2016. The steadily increasing unemployment rate is a powerful force applying downward pressure on interest rates.

The acceleration in the inflation rate forces interest rates up to 4.5 per cent by 2019.

The exchange rate

Two factors will combine to ensure acceleration in the decline of the Australian dollar. These are:

(i) the downgrade of the outlook for the world economy; and

(ii) the increase in the import propensity of the Australian economy via the destruction of manufacturing capacity,

However, the weaker economy and the decline in mining investment will offset the combined impact of the two factors listed above.

The lower domestic interest rate profile of this projection is partly offset by a lower world economic outlook and, therefore, lower world interest rates compared to what was projected previously.

As a result, there is little change to the projected profile in the exchange rate.

However, given the vulnerability of the Australian economy, the downward adjustment could be very sharp and at any time, which would involve a reduction to the 40 to 50 cent range to the United States dollar over a 6 to 12 month period. However, such an adjustment may well trigger a crisis which would take the economy on a very different trajectory than what is being outlined here.

Population

There has been only marginal downward adjustment in the population growth rate. Currently, the net increase in the population is averaging approximately 105,000 per quarter. Due to the steadily deteriorating labour market, this quarterly increase is projected to decline by 85,000 by early 2016.

The high unemployment rates at the end of the projection period are expected to reduce the increase in the national population to less than 60,000 by the end of the projection period.

That is, over the projection period the annual rate of growth of population will halve from current levels. It is likely though, that the next report will involve a further downward adjustment in the population growth rate at the very least over the last three years of projection period.

2.2.5 Current factors weakening the Australian economy

The factors which have contributed to the increasing structural imbalances, or economic vulnerability, of the Australian economy are:

(i) equity withdrawal and household debt – its negative impact on real incomes;

(ii) the under-provision of infrastructure – its negative impact on productivity;

(iii) mining expansion and the Dutch Disease – its negative impact on non-resource competing industries;

(iv) narrowing export base – banana republic – its risk of sharp downturn in export receipts;

(vi) financial sector disintegration.

Equity withdrawal

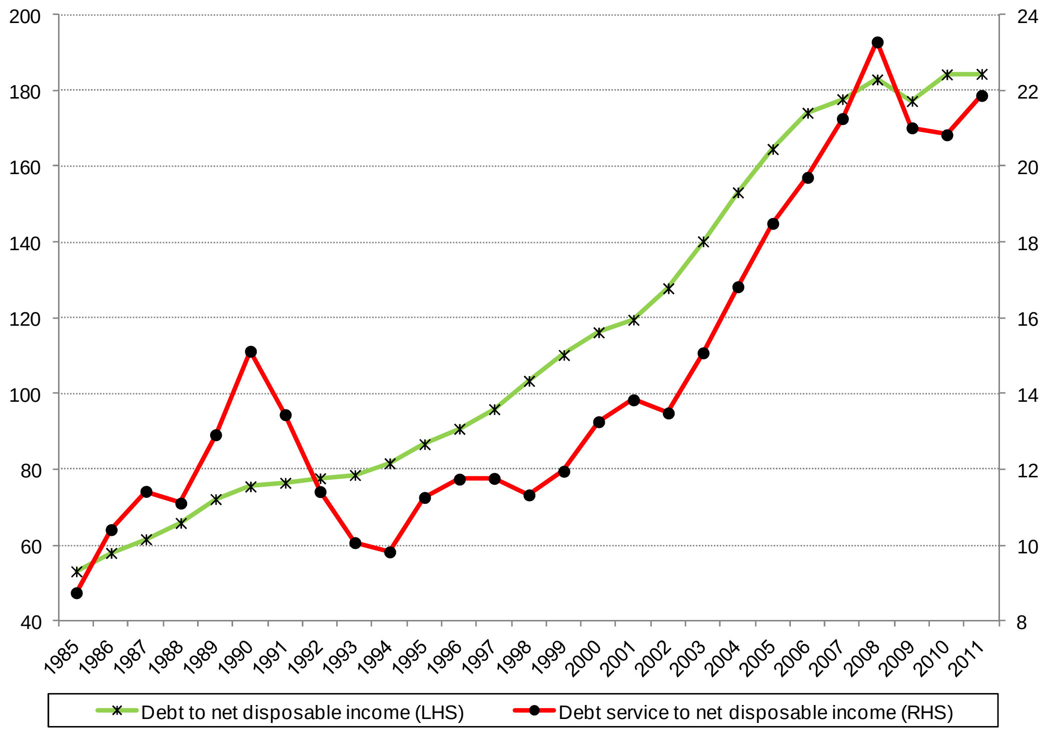
In terms of equity withdrawal or household borrowing for consumption expenditures between 1996 and 2013, Australian households borrowed $900 billion in 2010 prices. A large part of this was financed by foreign borrowings. This represents borrowings where the Australian economy has no capacity to repay.

Figure 2.4 shows the extent of the deterioration of Australian household finances over the last two decades. This will be a negative for Australian economic growth for years to come.

From Table 2.6, NIEIR's estimates of the Dutch Disease is that it has more than halved the benefit from the current mining boom by 2012-13 with only Western Australia being a significant beneficiary.

In terms of infrastructure investment, Table 2.4 shows the decline in transport infrastructure capital stock while Table 2.5 shows how this decline has reduced the productivity of business capital stock. If the mid 1985 ratio of transport capital stock to GDP had been maintained, Australian productivity in 2013 would be 4.0 per cent higher. From Table 2.5 the under-investment in transport infrastructure has resulted by 2012 in the marginal product of transport infrastructure capital stock being above the marginal product of business capital stock. This means that the economy would be potentially better off by reducing business capital stock and increasing transport capital stock by the same amount. From Table 2.5, Victoria would be better off by $6,000 per annum in GSP per $million dollars re-allocated.

Figure 2.4: Australian household debt and debt service ratios



Note: The debt service ratio is interest paid plus 6% of debt (repayments) as a percentage of net disposable income.

Table 2.4	The decline in Australian infrastructure investment by state			
	Transport infrastructure investments as a per cent of GDP		Transport infrastructure installed to business (non-mining) capital stock	
	1985	**2012**	**1985**	**2012**
New South Wales	20.9	18.6	27.3	18.7
Victoria	22.8	13.9	27.1	13.0
Queensland	28.9	22.7	32.1	22.0
South Australia	18.0	15.7	23.3	17.7
Western Australia	20.7	20.3	22.3	26.4
Tasmania	39.4	18.9	30.6	19.7
Australia	**23.2**	**18.3**	**27.8**	**18.8**

Table 2.5	Marginal products of business and transport infrastructure capital stock: 2012		
	Business capital stock	**Transport infrastructure capital stock**	**Difference between transport infrastructure capital marginal product and business capital stock marginal product**
At input levels of 2012			
New South Wales	0.12	0.16	0.04
Victoria	0.09	0.15	0.06
Queensland	0.10	0.18	0.08
South Australia	0.10	0.07	-0.03
Western Australia	0.12	0.25	0.13
Tasmania	0.11	0.18	0.07

Dutch Disease

Table 2.6 summarises the annual impact to 2013 of the Dutch Disease. By the ‘Dutch Disease’ is meant the loss of no resource:

(i) installed capacity;

(ii) installed capacity that otherwise would not have been installed,

as a flow-on impact of a mining boom as a result of the:

(i) high exchange rates;

(ii) increase in wages because of competitive bidding for labour by new profitable mining sector; and

(iii) diversion of installed funds to the mining sector from other sectors of the economy.

The loss of installed capacity comes from the loss of export markets and increased import competition.

From Table 2.6, by 2013 more than half the gross benefit from the mining expansion has been offset by the Dutch Disease. The estimates in the table indicate that New South Wales, Victoria and South Australia would have been better off in the absence of the mining boom.

These estimates do not take into account the loss of the motor vehicle industry.

Table 2.6 Cumulative impact of the Dutch Disease (2011 $ billion) – 2012-13 state GSP

	Gross impact	Crowding out	Net impact	Net impact % of GDP
New South Wales	15.3	25.8	-10.4	-2.3
Victoria	5.8	16.9	-11.1	-3.4
Queensland	22.6	19.4	3.2	1.1
South Australia	4.3	10.2	-5.9	-6.4
Western Australia	60.4	-6.3	66.6	27.5
Total	**108.5**	**66.1**	**42.4**	**3.0**

Note: Construction contribution to gross benefit is $67 billion in 2012-13.

Production benefits to come from LNG will be especially in the early years of limited domestic value with the majority of export receipts flowing back overseas in the form of interest payments, repayment of capital and dividends.

All costs of the Dutch Disease to 2012-13 have not been incurred – including the collapse of the motor vehicle industry.

The rise in Eastern Coast gas prices from $3 to $4 per gigajoule to $9 to $12 per gigajoule to supply the Gladstone LNG plants eroding what is left of import competing manufacturing.

It is impossible to see how the 2005-2016 mining boom will be a net positive for the economy by 2020.

The narrowing of the export base

The narrowing of the Australian export base is shown in Table 2.7. The substantial increase dependence of export receipts on one country and a small number of selected commodities means that any significant actions by China to reduce their dependence on Australian trade either because of political factors or alternatively by aggressive actions to reduce the usage of Australian commodities in its economy for example the use of coal for environmental reasons will have a considerable negative impact on the Australian economy as a whole.

Table 2.7 Australia: Increased vulnerability from narrowing export price

	1992	2012
Mining exports as % of total exports	20.7	55.8
Exports to China – % of merchandise exports	2.6	29.1

Financial disintegration

Over the past two decades considerable effort has gone into increasing the flow of financial savings in the Australian economy. The policy objective was to increase liquidity of the economy so that finance constraints would not be a factor in suppressing the growth of the economy by limiting investment expenditures. Unfortunately, there were no policy changes to ensure that the increased financial flows would flow into domestic investment. As a result, the increase in domestic financial resources was largely irrelevant to the investment effort as either the funds were used to finance consumption expenditures via equity withdrawal as noted above, or alternatively, in later years the mining expansion has been largely funded by foreign sources of capital.

Figure 2.5: $A/$US and $A/Euro exchange rates and weighted average exchange rate

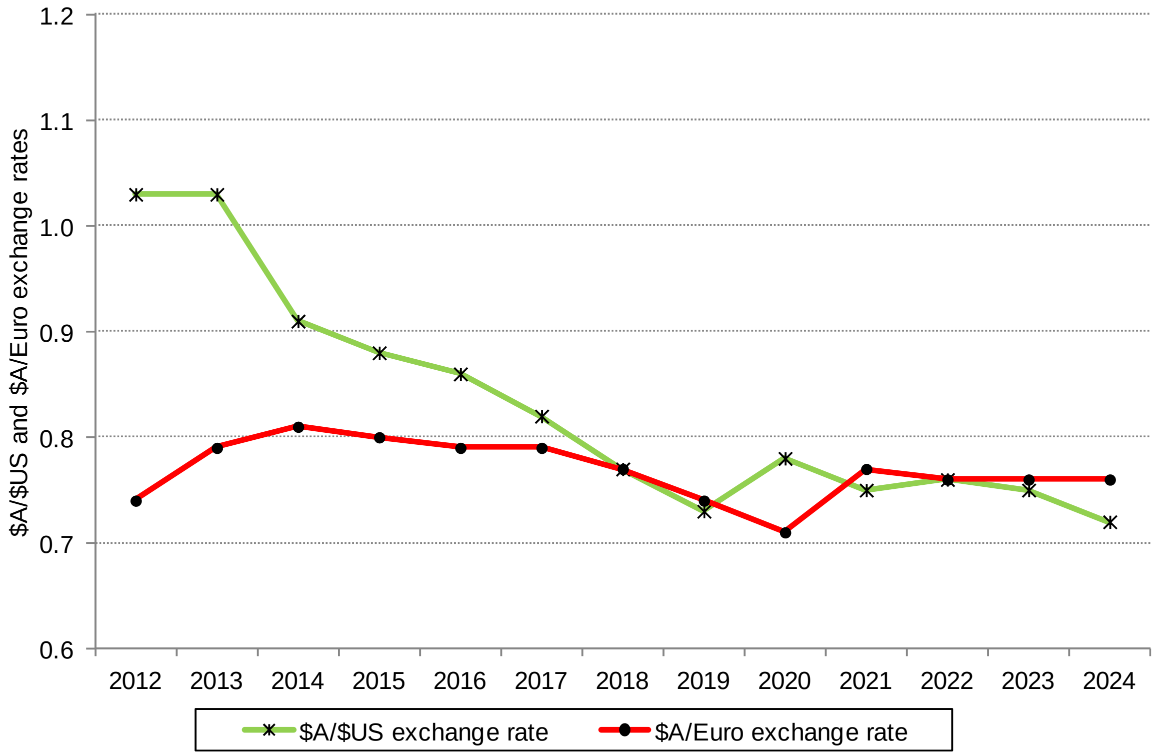


Figure 2.6: Australian population increase

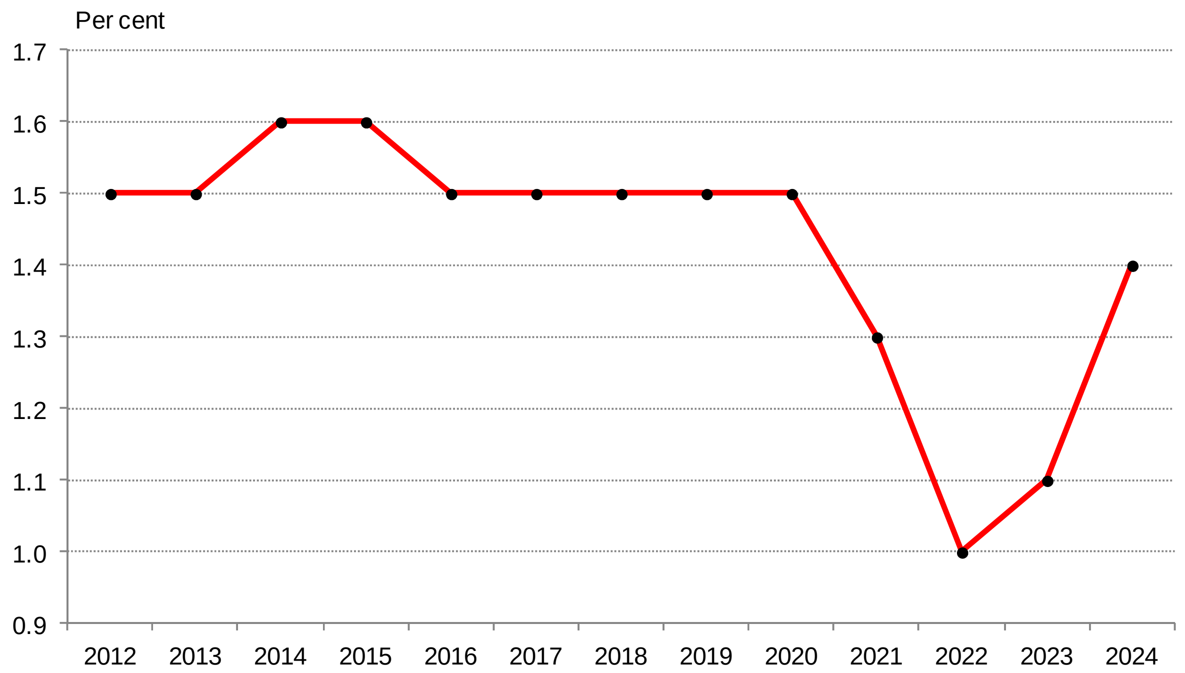


Figure 2.7: Labour market

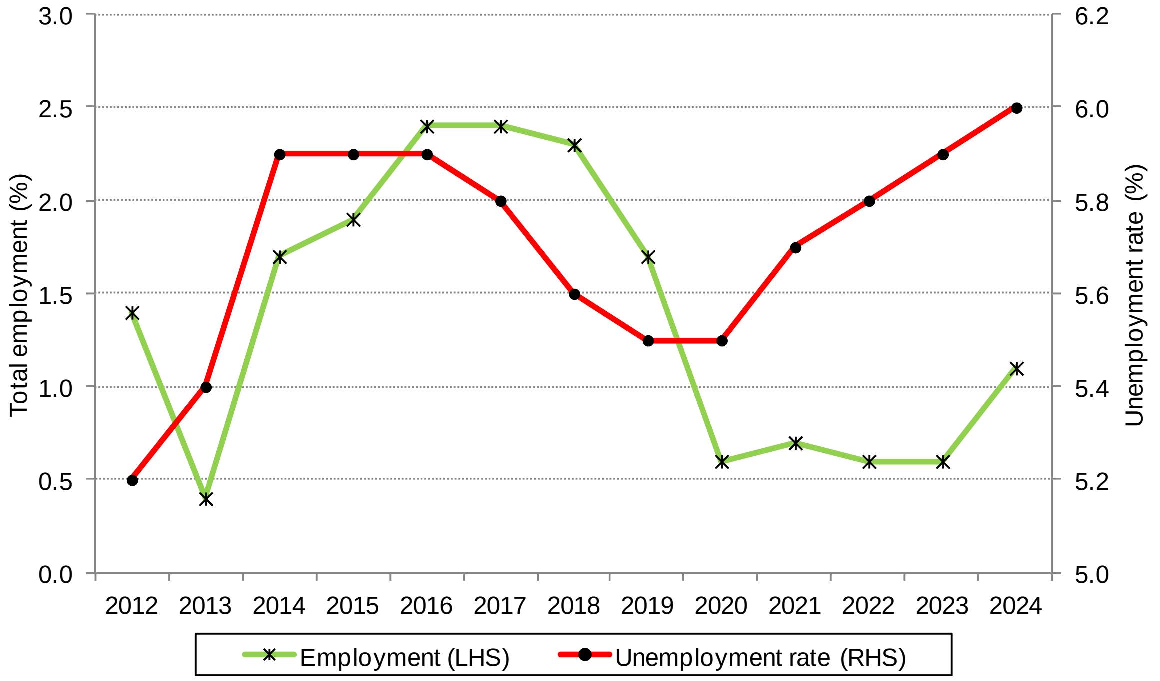


Figure 2.8: Interest rates

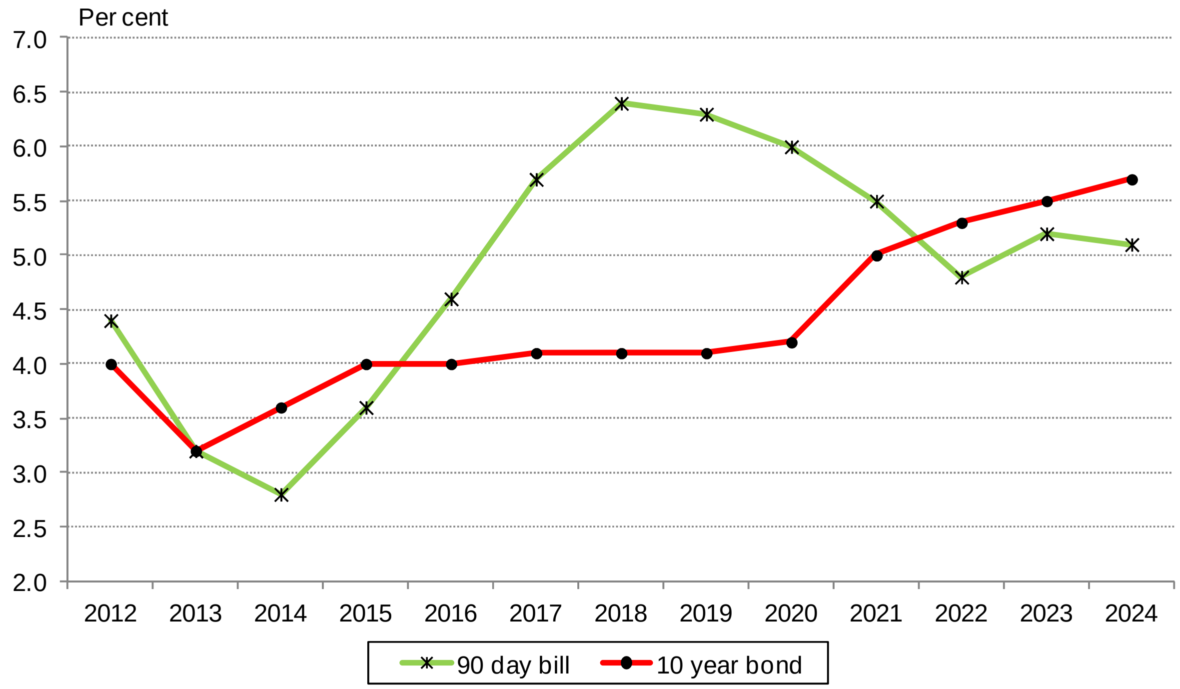


Figure 2.9: Current account balance

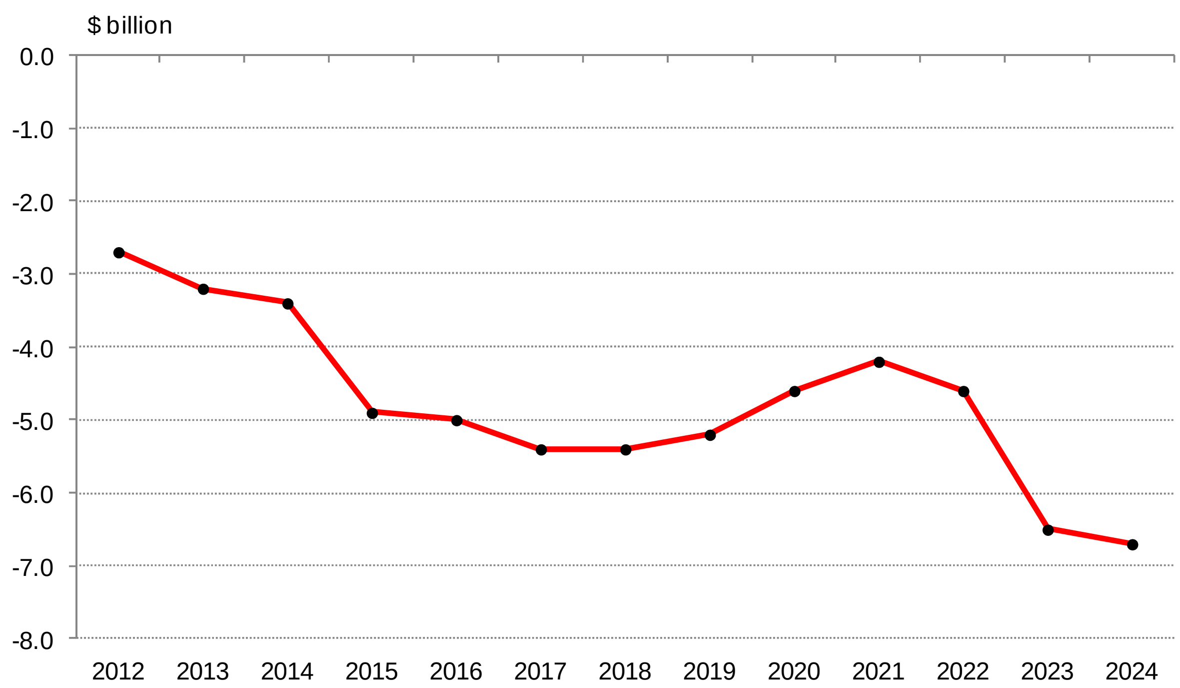


Figure 2.10: Overseas exports and imports of goods and services

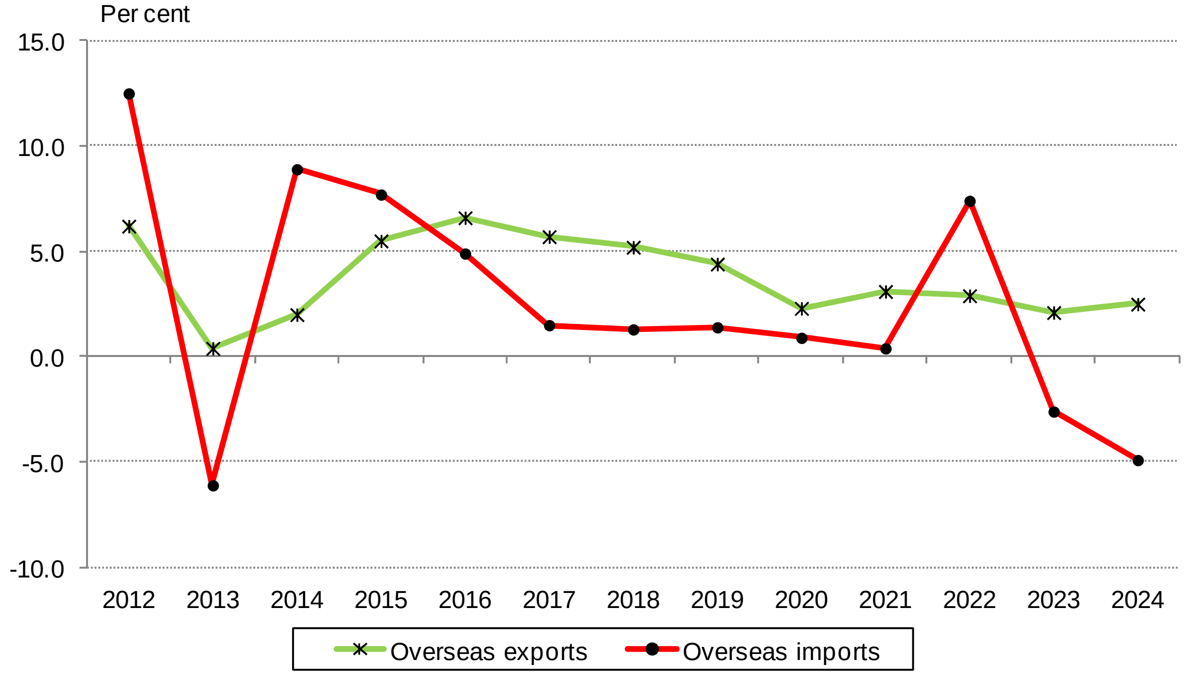


Figure 2.11: GDP and employment

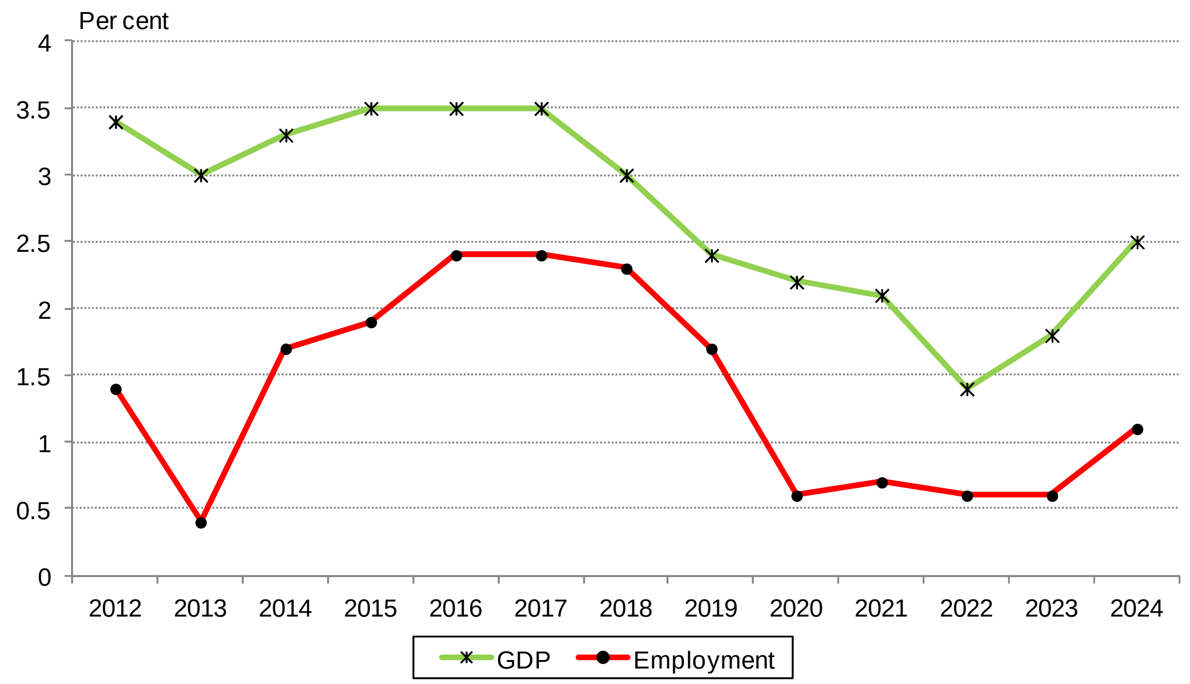
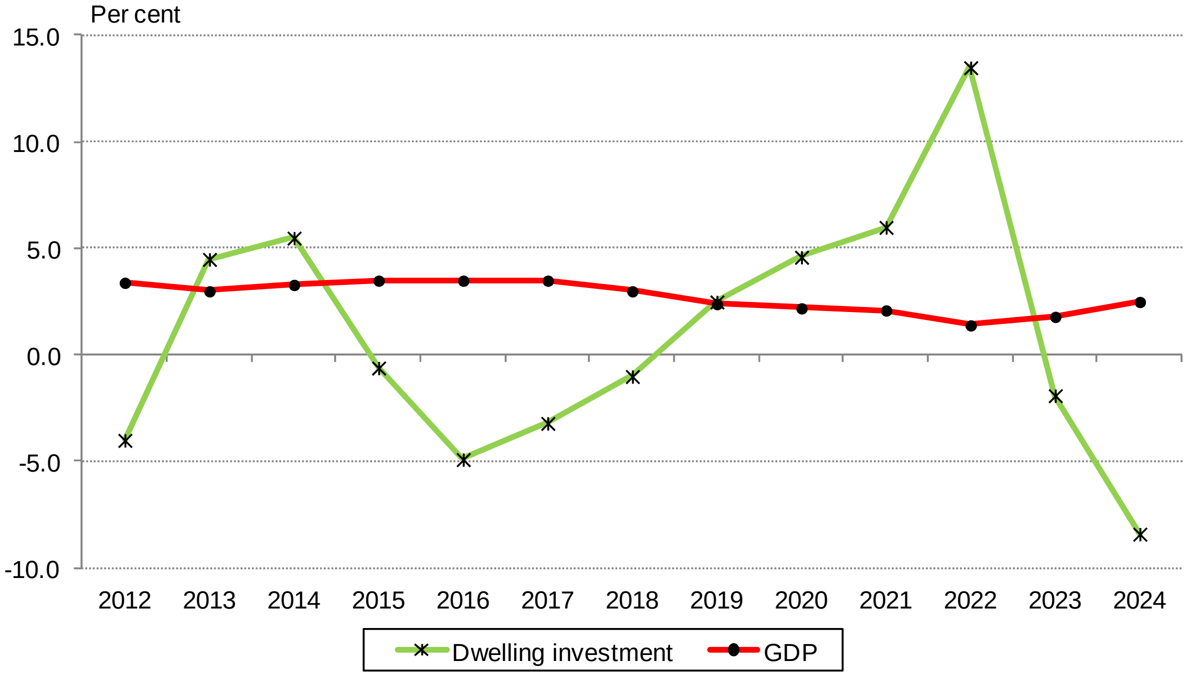


Figure 2.12: Housing sector



3. The outlook for Queensland to 2024-25

3.1 Introduction

This section outlines the economic outlook for Queensland to 2024-25, focusing on the short-term to 2018-19.

3.2 Summary of scenarios

Figure 3.1 shows the outlook for Queensland GSP growth by Base, High and Low scenarios from 2005-06 to 2024-25. Between 2012-13 and 2024-25, the projected average per annum GSP growth is expected to be:

- 3.0 per cent for the Base scenario;
- 4.1 per cent for the High scenario; and
- 2.1 per cent for the Low scenario.

Figure 3.1: Queensland GSP growth by scenario – 2005-06 to 2024-25

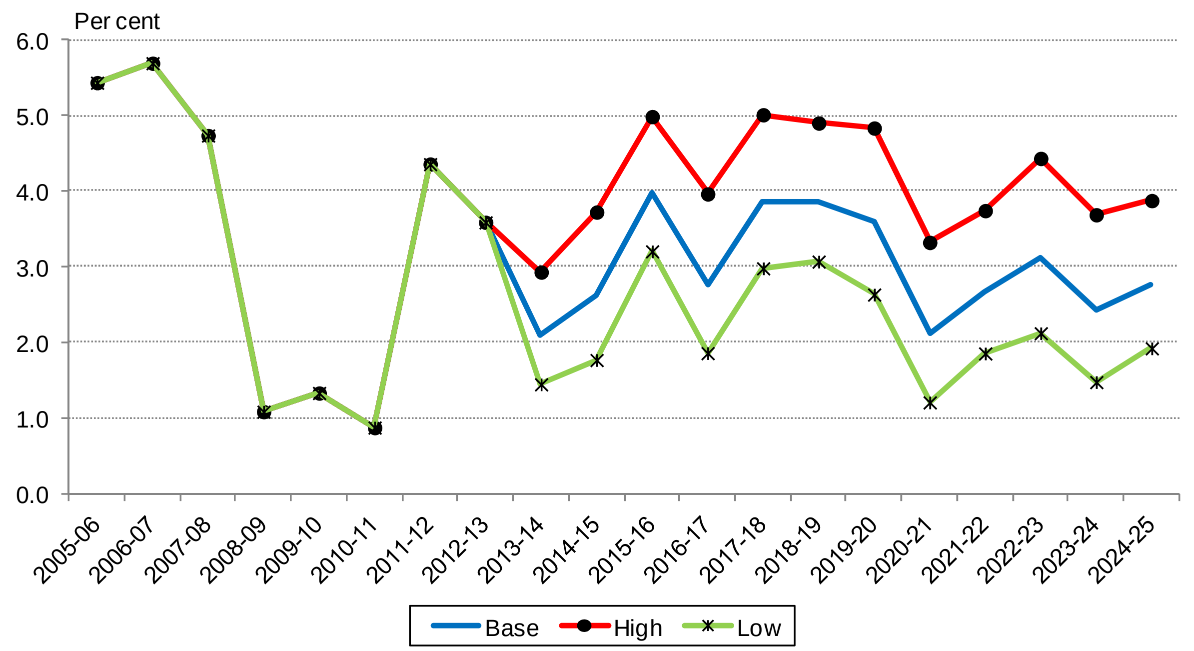


Table 3.1 shows the projected annual economic growth rates for Australia and Queensland for the period 2005-06 to 2024-25.

Table 3.1 Projected Australian and Queensland economic growth rate by scenario – 2005-06 to 2024-25

	Australia			Queensland		
	Base	High	Low	Base	High	Low
Per cent change						
2005-06	3.0	3.0	3.0	5.4	5.4	5.4
2006-07	3.8	3.8	3.8	5.7	5.7	5.7
2007-08	3.7	3.7	3.7	4.7	4.7	4.7
2008-09	1.7	1.7	1.7	1.1	1.1	1.1
2009-10	2.0	2.0	2.0	1.3	1.3	1.3
2010-11	2.2	2.2	2.2	0.9	0.9	0.9
2011-12	3.6	3.6	3.6	4.4	4.4	4.4
2012-13	2.7	2.7	2.7	3.6	3.6	3.6
2013-14	2.3	3.4	1.8	2.1	2.9	1.4
2014-15	2.4	3.0	2.0	2.6	3.7	1.8
2015-16	2.1	3.4	1.5	4.0	5.0	3.2
2016-17	2.2	3.6	1.4	2.8	4.0	1.9
2017-18	2.4	3.1	1.9	3.9	5.0	3.0
2018-19	2.7	4.3	2.3	3.9	4.9	3.1
2019-20	2.3	3.7	1.4	3.6	4.8	2.6
2020-21	1.7	2.8	0.5	2.1	3.3	1.2
2021-22	2.2	3.4	1.4	2.7	3.7	1.9
2022-23	2.6	3.9	1.4	3.1	4.4	2.1
2023-24	2.7	3.1	0.8	2.4	3.7	1.5
2024-25	3.2	4.4	2.1	2.8	3.9	1.9
Average annual growth rate (per cent)						
2012-13 to 2024-25	2.4	3.5	1.5	3.0	4.1	2.1
2013-14 to 2018-19	2.3	3.3	1.7	3.3	4.4	2.5
2018-19 to 2024-25	2.5	3.5	1.3	2.8	4.0	1.9

3.3 The Base scenario outlook for Queensland to 2018-19

Table 3.2 presents selected economic aggregates for Queensland to 2018-19 for the Base scenario.

Table 3.2 Macroeconomic aggregates and selected indicators – Queensland (per cent change)

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Compound average annual change 2012-13 to 2018-19
Private consumption expenditure	2.7	2.7	2.0	2.1	4.6	4.7	4.9	3.5
Private dwellings	-7.2	7.1	17.6	6.9	-3.1	-5.0	-2.8	3.4
Business investment	8.4	-14.9	-6.1	-0.2	2.2	-1.0	-1.5	-3.6
Government consumption	0.7	1.5	1.9	1.4	1.9	2.6	2.6	2.0
Government investment	-8.3	-12.1	6.6	4.4	5.6	1.1	10.0	2.6
State final demand	2.4	-1.5	1.5	2.0	3.3	2.6	3.4	1.9
Gross State Product	3.6	2.1	2.6	4.0	2.8	3.9	3.9	3.2
Population	2.1	2.2	2.4	2.4	2.4	2.2	2.2	2.3
Employment	0.3	1.2	1.5	1.2	1.5	1.8	2.2	1.6

Note: Percentage change unless otherwise specified.
Source: NIEIR.

Gross state product (GSP)

The Queensland economy is expected to continue to a short term recovery from economic instability remaining from the global financial crisis and natural disasters from 2008. The average economic growth is expected to be 3.3 per cent over the 2013-14 to 2018-19 periods, compared to a subdued average of 1.1 per cent over the 2009 to 2011 years. Australia, over the same period, will grow at a lesser average rate than Queensland of 2.3 per cent. The Queensland recovery is in part lead by favourable Australian macroeconomic conditions that will strengthen Queensland's export-competing industries.

The Australian exchange rate is expected to continue to depreciate from the above US dollar parity levels experienced in 2012 due to a weakening world economy and the decline of manufacturing in Australia. The historically high exchange rate made overseas travel appealing, which diverted private expenditure away from Queensland's local tourism industry. The tourism sector will benefit from a weaker exchange rate by attracting international tourists and encourage Queenslanders to holiday locally. This is reflected in household consumption expenditure which is expected to grow by 4.7 per cent over 2016-17 to 2018-19, up from 2.3 per cent in the preceding 2013-14 to 2015-16 forecast period. This is in part due to income provided by larger profit margins in the mining sector.

Severe drought from 2001 to 2007, followed by floods and cyclones, adversely affected Queensland's agriculture sector which contributed to the low 2009 to 2011 growth. If relatively favourable weather conditions from the recent years continue into the future, agricultural exports will also experience growth from a favourable exchange rate.

The recovery of the Queensland economy in 2011-12 and 2012-13 was aided by large increases in private business investment in the preceding years, with a 22.2 per cent increase in 2010-11 and a 37.5 per cent increase in 2011-12 driven by investment in the resources sector. In contrast, private business investment is expected to undergo an average decline of -3.6 per cent during the 2012-13 to 2018-19 period as investment in the mining sector is reduced. Major influential resource projects include the construction of a liquefied natural gas plant at Gladstone which is to open up the Australian LNG market to the world market as the facilities on Curtis Island are expected to commence exporting in late 2014. The LNG projects, coupled with the completion of construction in other mining projects from the investment boom, are to boost gross state product from around 2015-16 onwards, with a highest forecast growth rate in the short-term of 4.0 per cent.

Population

While the construction of new dwellings in Queensland historically follows a cyclical trend, population growth is a significant driver behind the growth in construction of residence households. The population in Queensland was estimated in 2012-13 to be 4.65 million people, a change of 2.1 per cent over the 2011-12 financial year. Population growth was relatively low in 2010-11 at 1.6 per cent, which was reflected in a drop in new dwelling approvals of 10.8 per cent. When population growth is at its peak in 2014-15 of 2.4 per cent, private dwelling investment increases by 17.6 per cent.

The natural increase in population has been consistent over the past three financial years at around 35,000 per annum (births less deaths).

The main source of strengthening population growth is net overseas migration, with around 35,000 in 2010-2011, increasing to 45,000 for both 2011-12 and 2012-13. However this remains lower than the 2008-09 level of around 60,000. Net overseas migration is recovering, and more overseas migration will occur as the employment rate continues to increase from 0.3 in 2012-13 to 1.2 in 2013-14. Net interstate migration increased from under 7,000 in 2010-11 to around 11,000 in 2011-12, but fell again in 2012-13 to around 8,000 in Queensland.

Over the 2012-13 to 2018-19 financial period the average Queensland population growth is expected to be 2.3 per cent. Population growth is expected to continue to increase from 2010-11 rate of 1.6 per cent, to a peak of 2.4 per cent in 2014-15 and remain relatively stable in the short term. This is mainly due to the recovering Queensland economy, which provides more future job opportunities with strengthening employment rates.

TABLE 3.3: ECONOMIC INDICATORS - ENERGEX AND QUEENSLAND

	ENERGEX REGION					QUEENSLAND				
	POPULATION	DWELLING STOCK	INDUSTR-IAL OUTPUT	COMMER-CIAL OUTPUT	GROSS REGIONAL PRODUCT	POPULATION	DWELLING STOCK	INDUSTR-IAL OUTPUT	COMMER-CIAL OUTPUT	GROSS REGIONAL PRODUCT
Unit	***** '000	******	********	$2001M	********	****** '000	******	********	$2001M	******
BASE										
2010	2999.29	1093.71	11584.61	85623.02	97207.63	4513.75	1638.72	30530.38	118452.58	148982.95
2011	3059.94	1113.44	11478.68	87576.02	99054.70	4599.53	1667.19	30606.20	120343.14	150949.34
2012	3123.37	1129.54	11817.84	92220.19	104038.03	4687.02	1689.88	31546.54	126703.92	158250.45
2013	3193.59	1144.95	12029.01	96790.86	108819.87	4784.38	1711.30	32160.18	132718.14	164878.31
2014	3269.74	1161.29	12272.94	102008.99	114281.93	4890.30	1734.26	33231.56	139032.38	172263.94
2015	3355.26	1183.20	12404.07	105516.63	117920.69	5009.87	1765.67	33644.99	143929.11	177574.09
2016	3442.91	1211.22	12648.52	110956.35	123604.88	5132.21	1806.27	34392.11	151283.52	185675.63
2017	3529.91	1242.82	13195.57	112400.15	125595.72	5253.19	1852.16	35634.12	154250.67	189884.78
2018	3614.85	1276.41	13422.53	118121.70	131544.23	5370.71	1900.94	37046.23	161001.75	198047.97
2019	3700.47	1308.88	13702.11	123563.77	137265.88	5488.86	1947.99	38592.82	168078.91	206671.73
2020	3788.61	1338.76	13884.95	129463.59	143348.53	5610.36	1991.16	40651.65	174337.98	214989.63
2021	3878.51	1367.01	13919.51	133079.97	146999.48	5734.07	2031.90	42468.20	178127.39	220595.59
2022	3957.17	1394.68	13964.08	138144.70	152108.78	5840.78	2071.64	45639.58	181803.78	227443.36
2023	4018.70	1419.26	14118.05	143302.64	157420.69	5921.91	2106.32	49847.39	185811.31	235658.70
2024	4089.11	1439.74	14112.94	148338.61	162451.55	6015.84	2134.69	56578.03	185818.20	242396.23
2025	4181.18	1460.78	14201.08	153243.42	167444.50	6141.28	2164.40	65950.06	184332.77	250282.84
Percentage changes										
2011	2.02	1.80	-0.91	2.28	1.90	1.90	1.74	0.25	1.60	1.32
2012	2.07	1.45	2.95	5.30	5.03	1.90	1.36	3.07	5.29	4.84
2013	2.25	1.36	1.79	4.96	4.60	2.08	1.27	1.95	4.75	4.19
2014	2.38	1.43	2.03	5.39	5.02	2.21	1.34	3.33	4.76	4.48
2015	2.62	1.89	1.07	3.44	3.18	2.44	1.81	1.24	3.52	3.08
2016	2.61	2.37	1.97	5.16	4.82	2.44	2.30	2.22	5.11	4.56
2017	2.53	2.61	4.33	1.30	1.61	2.36	2.54	3.61	1.96	2.27
2018	2.41	2.70	1.72	5.09	4.74	2.24	2.63	3.96	4.38	4.30
2019	2.37	2.54	2.08	4.61	4.35	2.20	2.47	4.17	4.40	4.35
2020	2.38	2.28	1.33	4.77	4.43	2.21	2.22	5.33	3.72	4.02
2021	2.37	2.11	0.25	2.79	2.55	2.21	2.05	4.47	2.17	2.61
2022	2.03	2.02	0.32	3.81	3.48	1.86	1.96	7.47	2.06	3.10
2023	1.56	1.76	1.10	3.73	3.49	1.39	1.67	9.22	2.20	3.61
2024	1.75	1.44	-0.04	3.51	3.20	1.59	1.35	13.50	0.00	2.86
2025	2.25	1.46	0.62	3.31	3.07	2.09	1.39	16.56	-0.80	3.25
Compound growth rate (per cent) -										
2010-2015	2.27	1.59	1.38	4.27	3.94	2.11	1.50	1.96	3.97	3.57
2015-2020	2.46	2.50	2.28	4.18	3.98	2.29	2.43	3.86	3.91	3.90
2015-2025	2.23	2.13	1.36	3.80	3.57	2.06	2.06	6.96	2.51	3.49

TABLE 3.3: ECONOMIC INDICATORS - ENERGEX AND QUEENSLAND (continued)

	ENERGEX REGION					QUEENSLAND				
	POPULATION	DWELLING STOCK	INDUSTR- IAL OUTPUT	COMMER- CIAL OUTPUT	GROSS REGIONAL PRODUCT	POPULATION	DWELLING STOCK	INDUSTR- IAL OUTPUT	COMMER- CIAL OUTPUT	GROSS REGIONAL PRODUCT
Unit	***** '000	******	********	$2001M	********	****** '000	******	********	$2001M	******
HIGH - Levels										
2015	3365.41	1187.13	13973.94	103355.54	117329.48	5025.03	1771.05	35306.00	142016.59	177322.59
2016	3462.62	1218.50	14497.60	109506.12	124003.71	5161.60	1816.65	36528.04	150466.36	186994.39
2017	3559.48	1253.57	15400.65	111765.78	127166.43	5297.19	1867.71	38418.04	154645.91	193063.95
2018	3653.56	1290.40	15959.97	118514.09	134474.06	5428.22	1921.32	40602.48	162748.92	203351.41
2019	3751.44	1327.21	16583.94	124962.98	141546.92	5564.47	1974.83	43083.98	170993.45	214077.44
2020	3851.16	1361.15	17139.82	132264.11	149403.94	5702.98	2024.03	46566.79	178559.89	225126.69
2021	3952.95	1393.53	17523.10	137310.19	154833.28	5844.11	2070.91	50317.04	183146.13	233463.16
2022	4042.48	1425.03	17903.08	143788.48	161691.56	5966.70	2116.31	56745.34	186228.83	242974.17
2023	4113.64	1453.04	18479.92	150815.75	169295.67	6061.81	2156.07	66461.09	188248.16	254709.25
2024	4194.77	1477.60	18850.39	157805.91	176656.30	6171.29	2190.50	83932.42	181028.08	264960.50
2025	4299.73	1503.06	19331.90	164556.66	183888.56	6315.40	2226.69	112617.83	163681.55	276299.38
Percentage changes										
2015	2.93	2.20	2.93	4.31	4.15	2.76	2.12	2.57	4.44	4.06
2016	2.89	2.64	3.75	5.95	5.69	2.72	2.57	3.46	5.95	5.45
2017	2.80	2.88	6.23	2.06	2.55	2.63	2.81	5.17	2.78	3.25
2018	2.64	2.94	3.63	6.04	5.75	2.47	2.87	5.69	5.24	5.33
2019	2.68	2.85	3.91	5.44	5.26	2.51	2.79	6.11	5.07	5.27
2020	2.66	2.56	3.35	5.84	5.55	2.49	2.49	8.08	4.42	5.16
2021	2.64	2.38	2.24	3.82	3.63	2.47	2.32	8.05	2.57	3.70
2022	2.27	2.26	2.17	4.72	4.43	2.10	2.19	12.78	1.68	4.07
2023	1.76	1.97	3.22	4.89	4.70	1.59	1.88	17.12	1.08	4.83
2024	1.97	1.69	2.00	4.63	4.35	1.81	1.60	26.29	-3.84	4.02
2025	2.50	1.72	2.55	4.28	4.09	2.34	1.65	34.18	-9.58	4.28
Compound growth rate (per cent) -										
2015-2020	2.73	2.77	4.17	5.06	4.95	2.56	2.71	5.69	4.69	4.89
2015-2025	2.48	2.39	3.30	4.76	4.60	2.31	2.32	12.30	1.43	4.53

TABLE 3.3: ECONOMIC INDICATORS - ENERGEX AND QUEENSLAND (continued)

	ENERGEX REGION					QUEENSLAND				
	POPULATION	DWELLING STOCK	INDUSTR-IAL OUTPUT	COMMER-CIAL OUTPUT	GROSS REGIONAL PRODUCT	POPULATION	DWELLING STOCK	INDUSTR-IAL OUTPUT	COMMER-CIAL OUTPUT	GROSS REGIONAL PRODUCT
Unit	***** '000	******	********	$2001M	********	****** '000	******	********	$2001M	******
LOW - Levels										
2015	3348.03	1176.31	11033.57	107613.60	118647.17	4999.08	1761.84	32042.49	145938.78	177981.28
2016	3428.26	1200.71	11082.41	112505.42	123587.84	5110.37	1798.55	32433.76	152460.45	184894.20
2017	3508.39	1228.83	11384.25	113338.42	124722.66	5221.16	1840.85	33179.68	154561.73	187741.41
2018	3584.09	1258.07	11395.75	118287.97	129683.71	5325.01	1884.76	33982.15	160375.00	194357.14
2019	3661.07	1286.38	11454.03	122963.84	134417.88	5430.42	1927.25	34798.73	166643.48	201442.22
2020	3740.35	1312.06	11412.25	127823.99	139236.23	5538.90	1965.80	35775.84	172040.22	207816.06
2021	3822.02	1336.35	11247.66	130365.51	141613.17	5650.55	2002.31	36243.66	175230.17	211473.83
2022	3893.26	1360.28	11106.87	134402.38	145509.25	5746.44	2038.18	37324.05	179156.70	216480.75
2023	3946.93	1380.57	11030.02	138193.22	149223.23	5816.15	2068.23	38486.96	183765.94	222252.89
2024	4008.18	1396.68	10836.71	141843.47	152680.17	5896.77	2091.78	40088.26	186543.86	226632.11
2025	4090.72	1413.42	10725.13	145426.42	156151.55	6008.41	2116.72	41880.61	190303.38	232184.00
Percentage changes										
2015	2.39	1.58	-0.52	2.77	2.46	2.22	1.59	0.18	2.83	2.34
2016	2.40	2.07	0.44	4.55	4.16	2.23	2.08	1.22	4.47	3.88
2017	2.34	2.34	2.72	0.74	0.92	2.17	2.35	2.30	1.38	1.54
2018	2.16	2.38	0.10	4.37	3.98	1.99	2.39	2.42	3.76	3.52
2019	2.15	2.25	0.51	3.95	3.65	1.98	2.25	2.40	3.91	3.65
2020	2.17	2.00	-0.36	3.95	3.58	2.00	2.00	2.81	3.24	3.16
2021	2.18	1.85	-1.44	1.99	1.71	2.02	1.86	1.31	1.85	1.76
2022	1.86	1.79	-1.25	3.10	2.75	1.70	1.79	2.98	2.24	2.37
2023	1.38	1.49	-0.69	2.82	2.55	1.21	1.47	3.12	2.57	2.67
2024	1.55	1.17	-1.75	2.64	2.32	1.39	1.14	4.16	1.51	1.97
2025	2.06	1.20	-1.03	2.53	2.27	1.89	1.19	4.47	2.02	2.45
Compound growth rate (per cent) -										
2015-2020	2.24	2.21	0.68	3.50	3.25	2.07	2.21	2.23	3.35	3.15
2015-2025	2.02	1.85	-0.28	3.06	2.78	1.86	1.85	2.71	2.69	2.69

All data are for the financial year ending in June of the year specified.

4. Electricity forecasting methodologies and modelling assumptions

This section outlines the methodologies employed and the key modelling assumptions used in developing electricity sales forecasts by class and maximum demands for the former ENERGEX distribution area in Queensland.

The centrepiece of the modelling was the application of NIEIR's state and energy industry based economic energy projection models. Appendix A provides an overview of NIEIR's energy modelling systems.

This section presents the methodology used to:

- forecast electricity sales; and
- forecast maximum demands.

4.1 Methodology – electricity sales forecasts

ENERGEX provided NIEIR with the following data:

- electricity sales by tariff from 1988-89 to 2013-14 for the ENERGEX distribution area; and
- electricity purchases for the ENERGEX distribution area from June 2000 to 2013-14.

Table 4.1 shows the Australian Standard Industrial Classification (ASIC) categories included in NIEIR's Queensland electricity forecasting model. Table 4.1 also shows the concordance between customer class categories and ASIC industry categories. Electricity consumption forecasts are based on econometric models which link Queensland electricity sales by industry to real output growth by industry, electricity prices, and weather conditions. Residential sales are determined from a model including average consumption per dwelling, weather, real income, and electricity prices.

ENERGEX provided NIEIR with aggregated sales data for the following classes:

- residential;
- commercial;
- industrial;
- public lighting;
- farm; and
- traction.

In order to link the ENERGEX distribution area data appropriately with NIEIR's existing industry based models, NIEIR then disaggregated business sales (commercial and industrial) for the ENERGEX distribution area into industry classes.

NIEIR calculated gross product for the ENERGEX distribution area region by industry class. Then, using the ABARE electricity consumption data, the State-wide electricity intensity by industry was applied to the ENERGEX distribution area output data. Additional adjustments were required to basic metals and mining electricity use outside the ENERGEX distribution area.

The forecasts of ENERGEX distribution area business electricity sales by class were therefore simply indexed to the sum of the relevant ASIC category forecasts.

Table 4.1	Reconciliation of customer class categories with ASIC industries
Customer class category	**ASIC**
Residential	
Commercial	Water and sewerage Construction Wholesale and retail trade Transport and storage Communication Finance, property, business services Public administration and defence Community services Recreation, personal and other services
Industrial	Agriculture, forestry, fishing, hunting Mining Food, beverages, tobacco manufacturing Textiles, clothing and footwear manufacturing Wood, wood products manufacturing Chemicals, petroleum, coal manufacturing Paper, paper products manufacturing Non-metallic minerals manufacturing Basic metal products manufacturing Fabricated metal products manufacturing Transport equipment manufacturing Other machinery and equipment manufacturing Miscellaneous manufacturing

Notes: ASIC refers to Australian Standard Industrial Classification.

1. The farm class which excludes residential farm is included in the industrial sector.

4.2 Methodology – forecasts for system maximum demand (MD)

Summary of modelling approach – summer maximum demands

NIEIR's approach to forecasting maximum demand involves decomposing load into temperature-insensitive load and temperature-sensitive load. When sufficient data are available, major industrial load and embedded generation are treated separately and then add back on to form potential maximum demand.

Forecasts of potential temperature-insensitive load are derived using a NIEIR's industry based energy model, which forecasts of all forms of energy by industry and state. The model is integrated with NIEIR's econometric input-output model of the Australian economy. Forecasts of temperature-insensitive load are produced for base, high and low economic growth scenarios.

Forecasts of potential temperature-sensitive load are derived differently for summer and winter MDs. Maximum winter temperature sensitive load is forecast using an econometric regression which relates the ratio of maximum demand and energy to daily average temperature. Maximum summer temperature load is estimated by forecasting space cooling appliance sales which are then converted to a MW capacity figure. Forecasts of temperature-sensitive load are produced for three potential temperatures to reflect the range of typical "hot"/"cold" weather conditions.

The key components to modelling summer MDs using AC data is to separate the total load into two components:

(i) base load or temperature insensitive load; and

(ii) temperature sensitive load.

Base load (i) refers to non-temperature sensitive residential, commercial and industrial load. It may include some space cooling; however, these units are normally operating, even at relatively mild temperatures.

Temperature sensitive load (ii) consists mainly of space cooling appliances such as refrigerative and evaporative AC and other ventilation equipment such as fans. AC load, however, dominates this component of load.

4.3 Temperature sensitive and insensitive demand for ENERGEX

Maximum demand is segmented into two parts:

- weather insensitive demand; and
- weather sensitive demand.

Weather insensitive demand is the part of demand that would occur irrespective of the weather conditions. The level of weather insensitive demand is roughly approximated by demand on a mild weather day (all other factors held constant). Weather sensitive demand is the part of demand that occurs due to the prevailing weather conditions. This part of demand reflects the intensity of available space conditioning equipment use. The level of weather sensitive demand can vary significantly depending on the prevailing weather conditions.

The proportions of weather insensitive demand and weather sensitive demand can be estimated (for any given year) using regression analysis.[1] Specifically, the weather insensitive part of demand can be inferred from the constant term (intercept) and the weather sensitive part can be inferred from the product of the temperature coefficient (the slope) and the temperature variable.[2] This section reviews some of the underlying trends in these two components that have given rise to the overall dynamics in the implied maximum demand levels.

Figure 4.1 shows temperature insensitive demand as estimated by the model for selected time intervals across summers; each interval is denoted by a different coloured line. At the 12:30 pm interval, the temperature insensitive demand is at its highest level as this is when collectively commercial and industrial activities are at its maximum. By evening time (5:30 pm), temperature insensitive demand has typically receded as many businesses (particularly within the commercial sector) are now closed for the day. As will be discussed below, yearly growth in insensitive demand broadly follows changes in annual electrical energy sales; many of the growth drivers of sales such as economic activity and electricity prices impact insensitive demand in a similar way although correlation has been somewhat decoupled in recent years.

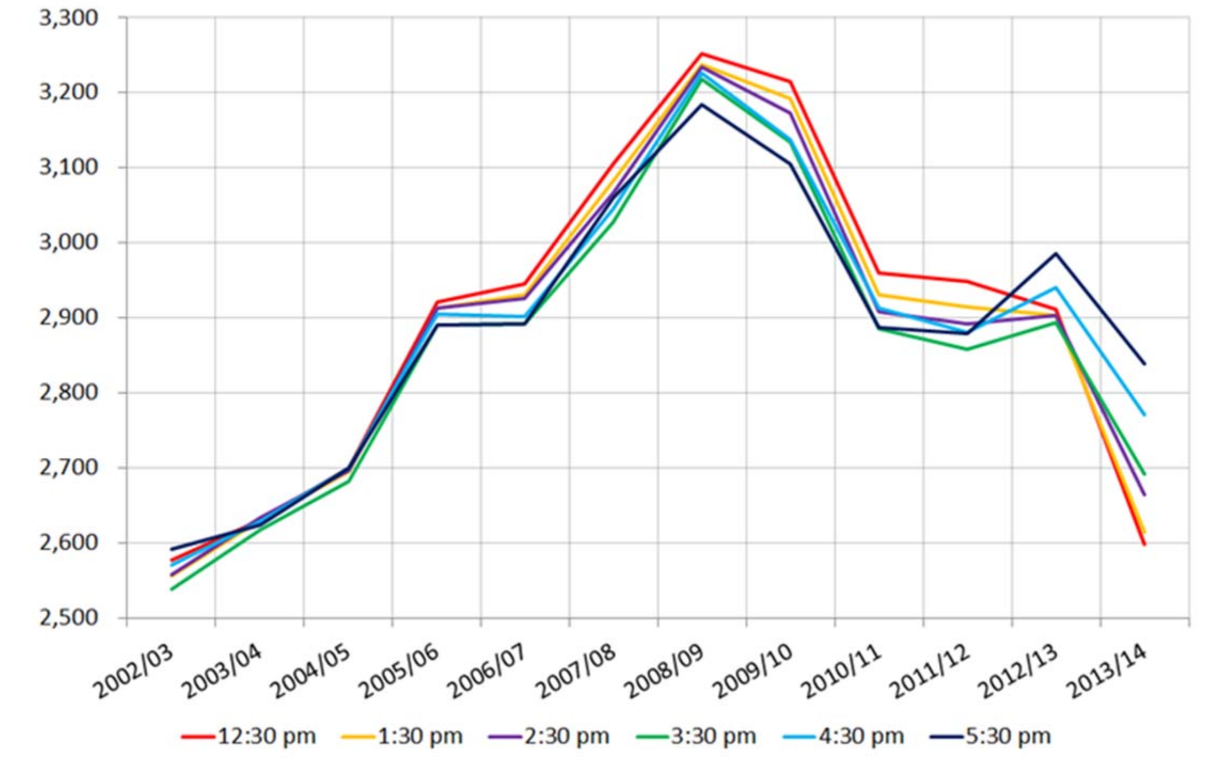
Figure 4.2 shows corresponding temperature sensitivity as estimated by the model for selected time intervals across summers; each interval is denoted by a different coloured line. At the 12:30 pm interval, the temperature sensitivity of demand is rising as temperature level continued to increase. By 3:30 pm, temperature sensitivity of demand has peaked or near its day's peak as households start to arrive home after day at work or school. The temperature sensitivity will typically stay high well into the evening as household go about their normal domestic activities. The large year-to-year movements reflect the inter-yearly climatic fluctuations; for instance, the unusually cool 2012-13 summer had somewhat reduced consumer's temperature sensitivity. Looking through the volatility, the temperature sensitivity of demand has continued to trend upwards; increased installation of space conditioning equipment arguably has driven this upward trend.

Taken together, these two figures suggest that the moderation in the growth in maximum demand in recent years to a large extent has been driven by falls in temperature insensitive demand and to a lesser extent, temperature sensitivity of demand.

[1] Temperature can be used as general indicator of prevailing weather conditions.

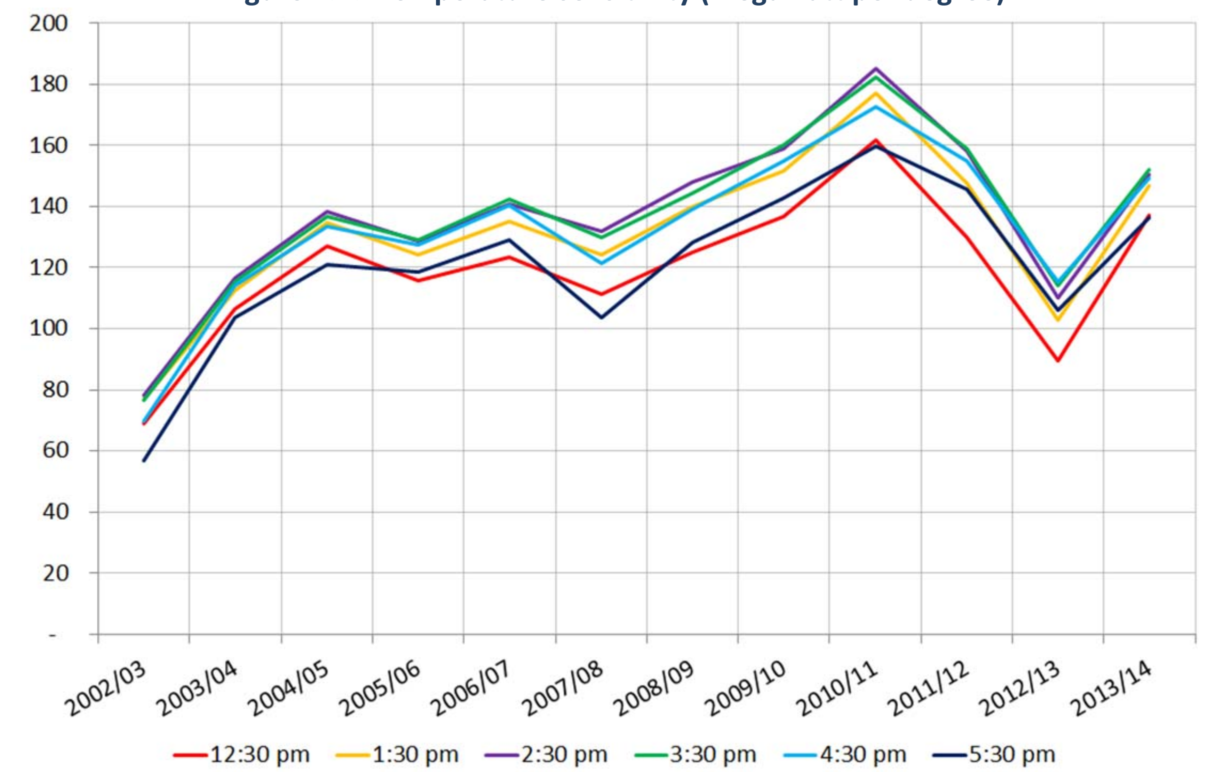
[2] Electricity demand has a greater range of influences than prevailing weather conditions. Many consumer activities routinely occur at certain points during the day or week. Therefore, electricity demand varies significantly across periods, independently of weather conditions. The regression analysis is structured to account for these 'routine' factors.

Figure 4.1: Temperature insensitive demand (megawatt)



Source: Temperature insenstive demand is from the National Institute.

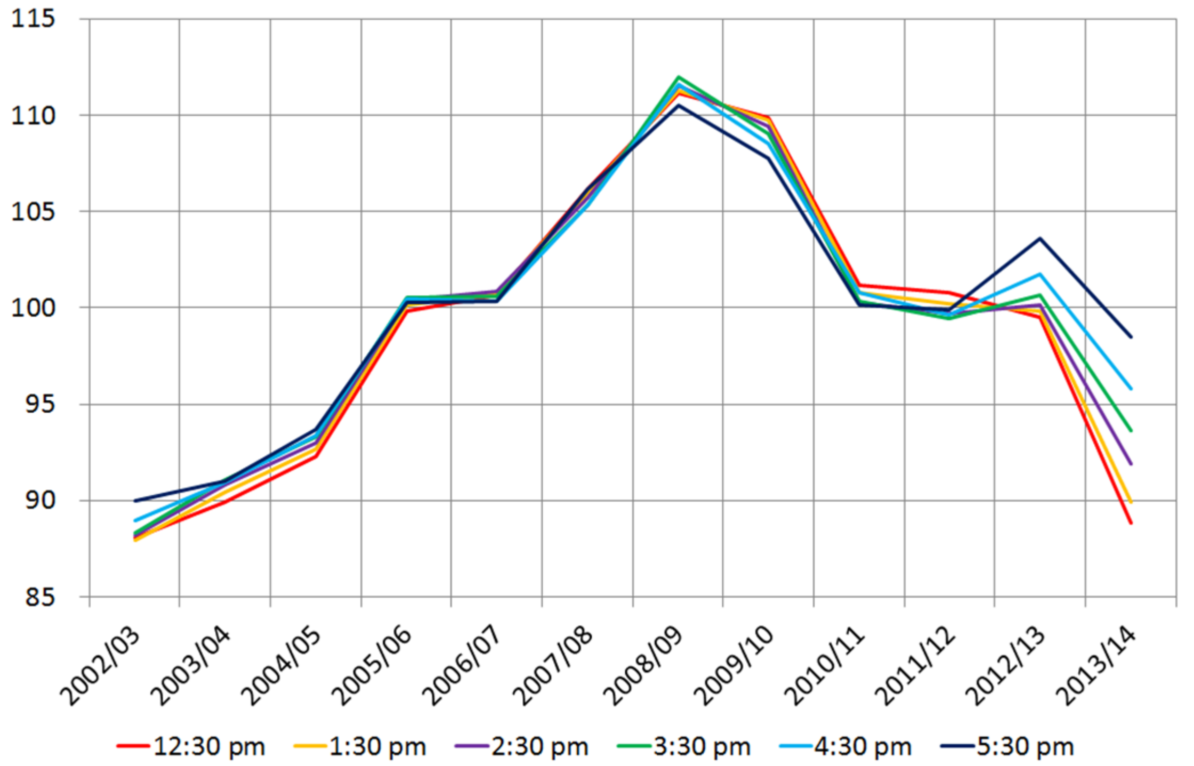
Figure 4.2: Temperature sensitivity (megawatt per degree)



Source: Temperature senstive demand is from the National Institute.

As can be seen from Figure 4.1, level of temperature insensitive demand between day time intervals and early evening has somewhat flipped in recent years. Figure 4.3 re-presents temperature insensitive demand profiles on a common indexed scale for comparison purposes; all series are indexed to 100 for average of 2000-01 to 2011-12 period. This figure shows that up until lately, the profiles for each time interval have moved in a similar manner from summer to summer. Over the past two summers, however, the falls (in percentage terms) have been more pronounced for daytime intervals than early evening intervals when sunlight is quickly receding.

Figure 4.3: Temperature insensitive demand across time intervals – average of 2000-01 to 2011-12 =100

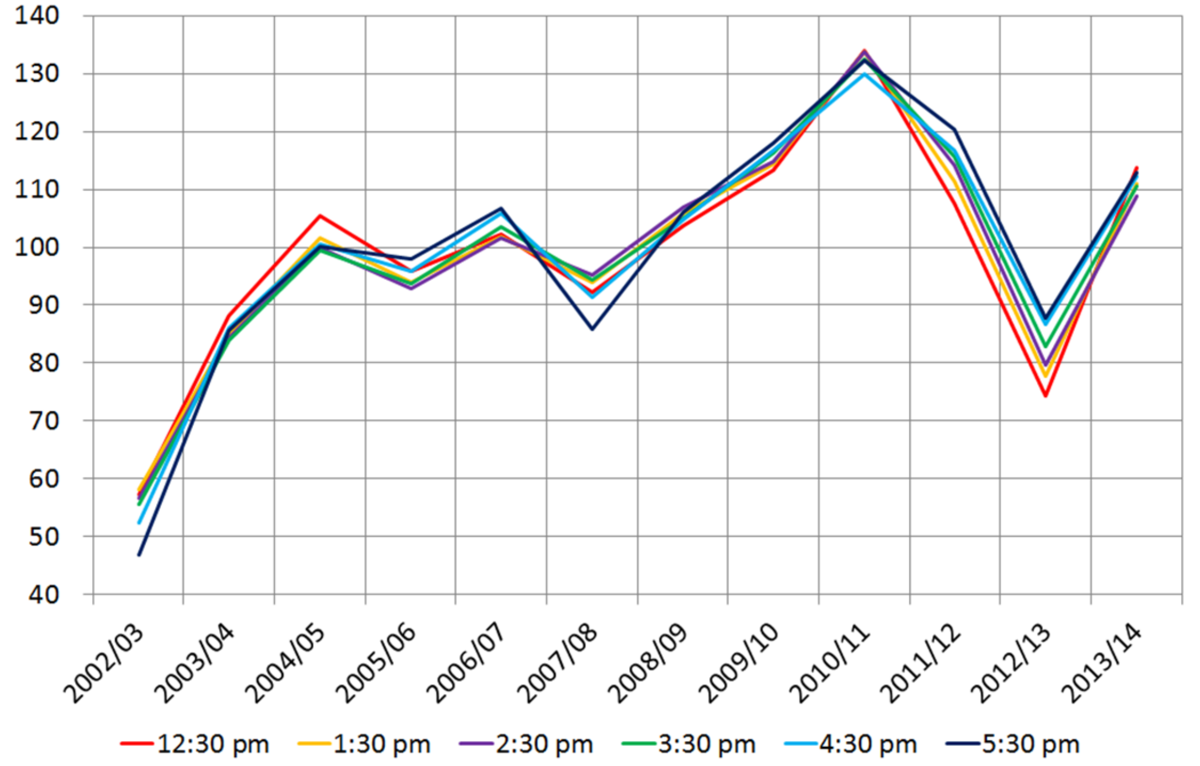


Source: Temperature insenstive demand is from the National Institute.

These changes in the diurnal patterns of temperature insensitive demand in recent years provide some circumstantial evidence that the proliferation of photovoltaic systems is having tangibly impacts on customer network demand.

Interestingly, there are no corresponding discernible impacts on temperature sensitive demand from the increased installation of photovoltaic systems. Figure 4.4 shows the corresponding profiles for temperature sensitivities for selected key time intervals on a common indexed scale; all series are indexed to 100 for average of 2000-01 to 2011-12 period. Of course, as noted earlier climatic fluctuations somewhat obscure the underlying trends in temperature sensitive demand. Nonetheless despite the volatility, temperature sensitivities across intervals appear to move together quite closely. Looking through the volatility, temperature sensitivity appears to have continued to grow over recent years albeit at a slower pace.

Figure 4.4: Temperature sensitivities across time intervals – average of 2000-01 to 2013-14 =100



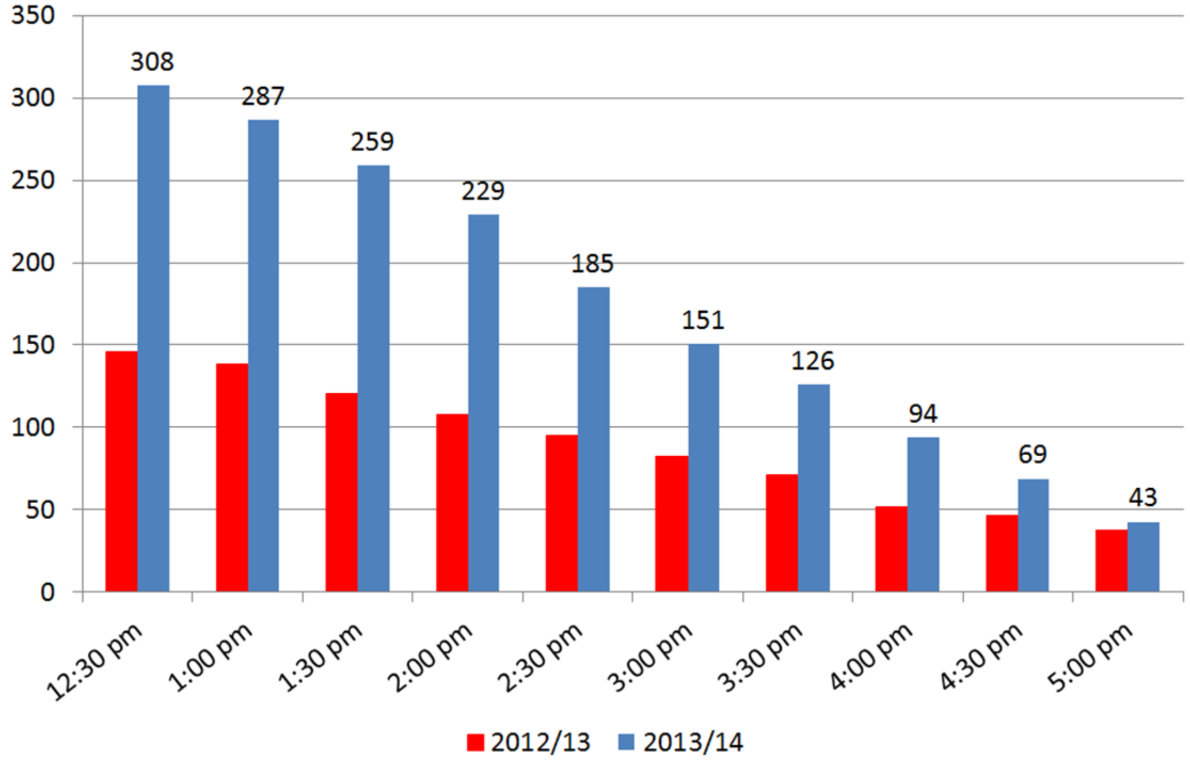
Source: Temperature senstive demand is from the National Institute.

These results suggest that generation is displacing part of temperature insensitive demand and not temperature sensitive demand. The exact extent to which generation of photovoltaic systems has displaced temperature insensitive (network) demand is difficult to measure. Nonetheless, a rough estimate can be gauged by comparing the estimated (megawatt) reductions in temperature insensitive demand with a counterfactual reduction in temperature insensitive demand (had there been no generation from photovoltaic systems). The 5:30 pm interval provides an indicative measure of the counterfactual reductions. On this basis, had the year-to-year profile of say the 3:30 pm temperature insensitive demand followed the profile of the 5:30 pm interval, temperature insensitive demand at 3:20 pm would have been around 151 megawatt (or 5.6 per cent) higher in 2013-14 (all other things constant).

Of course, this is a rough estimate as there are likely to be other factors that have contributed to the divergence in temperature sensitive demand (as measured by the two intervals). The prevailing conditions at each interval are somewhat different in terms of the composition of residential, commercial and industrial activities; at 5:30 pm, normal business hours have finished and many evening domestic activities are been undertaken. Moreover, customer lighting requirements are somewhat different at these two intervals. Year-to-year changes in both in the composition and the lighting requirements may have also contributed to the estimated 151 megawatt (reduction) difference. On this basis, this estimates may overstate the impact of photovoltaic systems. However, it may also somewhat understate the impact. Arguably, some photovoltaic systems are generating at 5:30 pm and so a small part of the falls in temperature insensitive demand at 5:30 pm over recent years can be also attributed to photovoltaic systems. At 5:30 pm, one would expect that generation levels on average would be very low and so this additional reduction would be low too. Nonetheless, the estimated reduction could also be greater than estimated 151 megawatts.

Of course, the implied counterfactual reduction in temperature insensitive demand at say 2:30 pm is greater than at 3:30 pm. Figure 4.5 shows the implied counterfactual reductions for each interval in 2013-14. This shows the reduction is greatest at 1:30 pm at around 55 megawatts.

Figure 4.5: Implied counterfactual reductions in temperature insensitive demand across intervals



Source: Implied from temperature insenstive demand estimates from the National Institute's Peaksim Model.

Households and businesses with photovoltaic systems only require electricity from the network when their own generation is lower than their in-house/on-site demand. While many customers with photovoltaic systems will arguably attempt to match their own demand with their generation levels (by shift certain discretionary activities within day and across days), their ability to do this across all weather conditions will be constrained by the size of their photovoltaic system. On this basis, their own generation (depending on size of the specific system) may meet (on average) all or part of a customer's own demand on milder weather days (temperature insensitive demand) and will only meet some of their demand on hotter days (possibly part of temperature insensitive demand and none or small fraction of temperature sensitive demand depending on sunshine).

Even the larger systems seem to draw electricity from the grid at some intervals during hot sunny days suggesting that most operating systems are not sufficiently sized to meet a customer's own demand at every interval during the day. Moreover, it is feasibly that the overall demand of customers with a photovoltaic system (that is, total demand met by own generation and the network) may have increased as a consequence of the lower effective electricity prices now being paid by customers with a photovoltaic system and the (potentially) new income stream derived from the sales of electricity back to the grid. Feeling better off, customers with a photovoltaic system may have changed their consumption patterns across all weather conditions and all intervals of day.[3]

Given a customer with a photovoltaic system are constrained by the prevailing levels of sunlight, any increase in overall demand therefore will have to be met by the network. Feeling better off, customers with a photovoltaic system may also have changed their consumption patterns across all intervals of day, even non-daytime intervals (irrespective of weather). It is possibly that customers with a photovoltaic system may also choose to increase demand during non-daytime intervals. If this is case, the fall in energy sales may have been greater if customers with a photovoltaic system had continued to consume electricity in a similar manner to before the installation of their system. While this is somewhat hypothetical, it is nonetheless conceivably that lost network sales due to day time generation is partly offset by increased sales to photovoltaic customer in evening due to income and relative price effects.

Base load estimates for ENERGEX are presented in Table 4.2. ENERGEX base load has been steadily declining over the last five years.

Table 4.2	Base load at 2:30 p.m. – ENERGEX (MW)
1995-96	1,730
2000-01	1,895
2001-02	1,970
2002-03	2,040
2003-04	2,133
2004-05	2,255
2005-06	2,346
2006-07	2,405
2007-08	2,445
2008-09	2,479
2009-10	2,445
2010-11	2,374
2011-12	2,281
2012-13	2,226
2013-14	2,182

Modelling sales of new air conditioners – The underlying demand for air conditioning

The key determinants of the overall demand for air conditioning are:

- the dwelling construction cycle and the characteristics of dwellings under construction (flats, townhouses, detached dwellings);
- the ambient temperature of the summer months of December to February in particular; and
- commercial sector business formation by industry sector.

[3] With reference to a well-established equation in neoclassical microeconomics called the 'Slutsky equation', the improved purchasing power from reduced effective price may alone induce an increase overall demand in such a way.

Purchase of air conditioners by the residential and commercial sectors falls into the following categories:

- replacement demand (that is, the replacement of a defective unit or a unit which no longer meets the space conditioning requirements);
- new demand which is planned and deliberate which may be associated with a new dwelling, apartment or other building or a renovation to an existing dwelling or building; and
- impulse purchases made during a period of high summer temperatures.

New demand for air conditioning units is partly related to the dwelling construction cycle and the type of residential construction. Medium to high density housing and unit construction in Brisbane are likely to have a higher penetration of air conditioning systems than detached dwellings on the urban fringes. Given the cost of air conditioning systems in terms of both capital and running costs, the distribution and growth in Queensland household incomes is likely to be an important determinant of sales growth.

The actual level of purchases from the above categories of demand depends, in turn, upon:

- the levels and growth in household disposable income and company cash flows;
- the price to purchase and install air conditioning systems; and
- the running costs or electricity charges to operate air conditioning.

As in the case of all other goods and services, the purchase decision will usually be weighed up against other discretionary or non-discretionary purchases of other goods or services.

An econometric equation was developed for air conditioning sales that took account of temperatures over summer, real income per capita, building completions and a replacement rate.

Table 4.3 Actual space cooling utilisation rates – ENERGEX

	10th percentile summer	50th percentile summer	90th percentile summer
10th percentile MD	0.695	0.685	0.675
50th percentile MD	0.625	0.610	0.590
90th percentile MD	0.600	0.530	0.400

The utilisation rates have been successively revised downwards as the stock of air conditioning equipment has increased in Queensland. They were revised in 2007, 2008 and 2010 following completion of the backcasting exercises (see Chapter 7).

4.4 Distribution of seasonal extreme temperatures

The seasonal maximum demand forecasts are conditioned on a set of seasonal extreme temperature levels. These temperature levels summarise the distributions of summer's highest and winter's lowest temperatures. The distributions are represented by probability of exceedance (POE) values. These POE values show the potential variations in these extreme temperature events and their relative likelihood.

All temperature data used to calculate temperature POE values have been obtained from Australian Bureau of Meteorology. The temperature POE values are calculated using 'average' daily temperature readings (that is, the arithmetic mean of the maximum and minimum daily temperature readings). The temperature data are from two locations in Brisbane: Amberley AMO (station number 40004) and Brisbane Aero (station numbers 40223 and 40284). Amberley AMO readings are used to measure summer extreme temperatures in the ENERGEX distribution area, while Brisbane Aero readings are used to measure winter extreme temperatures.

The sample data span the period 1959-60 to 2013-14 for summer and 1960 to 2013 for winter. These were recalculated in 2014. The previous percentiles were calculated in 2006. Summer is defined as December, January and February consecutively and winter is defined as June, July and August consecutively. The summer holidays, which is defined as 20th December to 20th January, are excluded from the calculation of the summer temperature POE values as maximum-demand events typically occurs outside this period.

Over the past fifty years, the summer highest temperature has tended to increase; there appears to be no noticeable change in the mean level of winter lowest temperatures. The trend increase in summer extreme temperatures may reflect a number of factors including changes to the weather metering equipment, changes to the environment surrounding the weather station, general city-wide urban development (i.e., heat island effect) and global warming. This trend suggests that the underlying distribution is not stationary and therefore, the summer extreme temperatures observed in the past are not directly comparable to summer extremes observed today. To put the past temperature extremes on the same basis as today's extremes, the summer highest temperatures are detrended and then recasted in terms of today's mean (trend) level. The recasted series is used to calculate summer POE values.

The 10% POE value is the 90th percentile value. In a sample of 51 observations (years), the 90th percentile is the 5th highest temperature reading. The 50% POE value, which is the median value or middle observation, is the 26th highest observations in a sample of 51 observations. The 90% POE value is the 46th highest (or 5th lowest) observations in a sample of 51 observations. Table 4.4 presents the 10%, 50% and 90% POE values for summer highest and winter lowest temperatures.

Table 4.4 Temperature POE values for summer highest and winter lowest temperatures

	Summer highest		Winter lowest
10% PoE	32.0	10% PoE	12.0
50% PoE	30.2	50% PoE	10.9
90% PoE	28.6	90% PoE	9.8

The forecasts for summer maximum demands are also conditional on POE values for summer 'mean' temperature[4]. Table 4.5 presents the 10%, 50% and 90% POE values for summer mean temperatures.

Table 4.5 Temperature POE values for summer mean temperatures

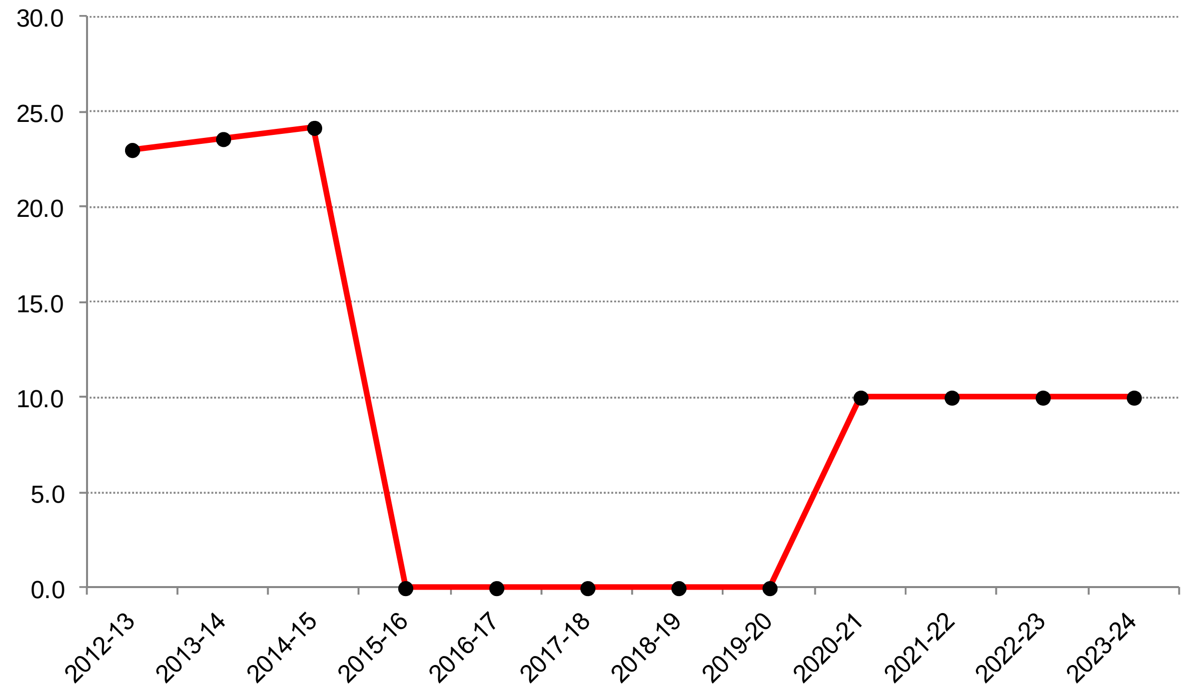
	Summer mean
10% PoE	26.0
50% PoE	24.9
90% PoE	24.1

4 The calculation of summer mean temperature POE values incorporates all days of summer including the summer holiday period.

4.5 Carbon (CO_2e) pricing impacts

Carbon pricing will increase the prices of electricity and gas according to the CO_2e price and the CO_2e content of fuels used to produce electricity. The carbon content of gas used to provide end-use energy services results in increased end-use gas prices. In end-use markets energy users will respond to increased energy prices by reducing energy demand, particularly in the longer term when energy using equipment can be changed. Carbon pricing also changes the generation mix required to balance demand and supply towards gas and renewables.

Figure 4.6: Real carbon price ($2012)



The CO_2e price is $23/t from 2012-13 to 2014-15.

The demand response, that is, the price elasticity of demand for electricity, is estimated to be about -0.3 in the long-run. High real price increases such as the ones that have occurred in Australia over recent years could engender a short-run response close to the long-run elasticity, or even greater.

From an electricity demand viewpoint, the focus of electricity retailers on CO_2e pricing impacts will be on the following.

(i) CO_2e pricing will increase electricity prices and reduce demands compared with no carbon pricing.

(ii) Gas prices will also rise and accordingly gas versus electricity competition may not be significantly affected.

If the current Federal Government removes the carbon tax, electricity and gas prices could still rise as a result of Opposition climate change policies. The impact, however, is indeterminate at this time. In this projection carbon pricing is re-introduced in 2020-21.

Table 4.6	Real electricity prices – Queensland (2009-10 prices)		
	Residential	Business	Total
2004-05	14.7	9.5	11.1
2005-06	14.8	9.6	11.1
2006-07	14.8	9.6	11.2
2007-08	15.9	10.2	11.9
2008-09	16.6	10.6	12.4
2009-10	18.7	11.8	13.9
2010-11	20.4	12.8	15.1
2011-12	21.2	13.3	15.7
2012-13	23.5	15.2	17.7
2013-14	27.3	16.2	19.6
2014-15	30.2	17.0	21.0
2015-16	30.9	17.7	21.7
2016-17	31.3	18.1	22.1
2017-18	31.6	18.4	22.4
2018-19	30.9	17.7	21.7
2019-20	29.8	16.8	20.7
2020-21	30.4	17.6	21.4
2021-22	30.2	17.6	21.4
2022-23	30.0	17.6	21.3
2023-24	29.6	17.4	21.1
2024-25	29.4	17.4	21.0

The QCA, in May 2014, approved a 13.6 per cent price increase from July 2014 for standard domestic tariffs in Queensland.

4.6 Queensland climate change policy impacts on energy use and demand

4.6.1 Introduction

The current Queensland state government has implemented significant reductions in the number and scope of state climate change and renewable energy policies. The Solar Bonus scheme is a notable exception with the government obliged to continue to support generous feed-in tariffs paid to existing customers up until 2028, and will support new customer feed-in tariffs at a reduced rate. The majority of previous state governments' initiatives have now been closed in an effort to reduce energy cost pressures to consumers. In the 2013-14 state budget speech, the treasurer announced his intention to have the contributing cost of green policy to be listed on customer electricity bills. This is one such indication that Queensland energy policy is now focused on price rather than environmental conservation.

The primary impact of climate change measures will therefore derive from national policy and programs. However, similar trends are present in the Federal government, as programs such as the Renewable Energy Target are under review and continuation of such initiatives is subject to considerable uncertainty. This is in addition to the replacement of the carbon tax mechanism with the Direct Action Plan as an alternate approach to the abatement of greenhouse emissions.

This section presents an analysis of the policy measures, incentives, and subsidies nationally and in Queensland related to energy. The analysis suggests that the way energy is used will undergo change in the future.

4.6.2 Queensland state policy measures

Solar bonus scheme

The Queensland Solar Bonus scheme introduced a feed-in tariff rate for eligible customers who installed a solar photovoltaic (PV) system and connected the system to the electricity grid. The scheme pays customers for the excess electricity they generate from their PV systems above the energy they consumed during the day[5].

The initial generous feed-in tariff was set at 44 cents per kilowatt hour. This was to stimulate the Queensland PV industry by creating a financial incentive for consumers to consider installing solar panels.

As of July 2012, the scheme closed to new applicants and a lesser replacement feed-in tariff of 8 cents per kilowatt hour was offered to new eligible installations.

Existing Solar Bonus Scheme participants will continue to receive the 44 cents per kilowatt hour rate up until 1 July, 2028 so long as they still meet eligibility criteria. Criteria includes that the applicants remain and pay electricity bills at the same address in which they applied, and that they do not increase the capacity of the installed panels.

At this time, there are more than 240,000 participants in the scheme.

5 http://www.dews.qld.gov.au/energy-water-home/electricity/solar-bonus-scheme.

The Queensland Competition Authority (QCA) modelling projects the scheme will add more than $118 per year to average power bills in 2013-2014, peak at $276 in 2015-16, and fall to $98 on an average power bill by 2019-2020. This equates to a 16.6 per cent on the average electricity bill when the cost of the scheme is at its greatest, and is expected to fall to 6.6 per cent by 2019-20. The cost is reflected in both those with and without PV installed in their residence.

The QCA presented their 2013 review findings in the final report *Estimating a Fair and Reasonable Solar Feed-in Tariff for Queensland*. The QCA do not support a regulated minimum feed-in tariff for the South-East Queensland retail electricity market. They recommend a regulated minimum tariff of between 7.06 and 14.05 cents per kWh for customers in the Ergon distribution network dependant on the region.

In accordance with the QCA review, the Queensland government decided to replace the 8 cents per kilowatt hour feed in tariff when it expires on July 1, 2014 with:

- a regulated feed-in tariff for regional Queensland; and
- a feed-in tariff set and paid by electricity retailers in South East Queensland.

The difference in feed-in tariff treatment is due to the amount of competition in the electricity retail sector in the respective areas. The competition is not sufficient to maintain a fair and reasonable price for regional Queensland; hence the feed-in tariff will remain regulated going forward.

Business sustainability programs through ecoBiz

ecoBiz is a free, voluntary eco-efficiency program which provides Queensland businesses with tools, training and detailed information to help improve their efficiency by reducing water, waste and energy usage. Since November, 2013 the program is run by the Chamber of Commerce & Industry Queensland, an industry body and lobby group, and funded by the Department of Environment and Heritage Protection.

The program is mostly educational, rather than providing any direct funding measures to businesses. The program involves attending webinars. An ecoBiz consultant is available to aid the business by completing a site survey to identify efficiency improvements. The consultant can then help complete an action plan and implementation plan for a selection, or all of, water, waste and energy improvements. A business which takes part can be expected to commit a maximum of 30 hours over 12 months in the program.

For participating businesses, the program claims to reduce on average[6]:

- energy consumption by one-fifth;
- water use by one-third; and
- waste by almost one-half.

There are some opportunities for businesses to obtain funding through ecoBiz. For example, ecoBiz has provided Clean Technology Grants to businesses to install energy efficient technologies such as PV systems and efficient lighting[7]. As of January, 2013 there were 600 businesses participating in the program[8].

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6 http://www.cciqecobiz.com.au/how-ecobiz-works/.

7 http://www.cciqecobiz.com.au/news/clean-technology-grants/.

8 http://www.ecocitizenaustralia.com.au/queenslands-innovative-ecobiz-program/.

State policy closures

Table 4.7 summarises the climate change and renewable energy policies that have recently expired or the state government has closed since 2012.

Table 4.7 Previous Queensland State Government policies and initiatives

Policy	Timing
Queensland Renewable Energy Fund	Renewable Energy Industry Development Plan
Queensland Climate Change Fund	The Climate Smart Business Service
Solar Initiatives Package	Queensland's Solar Flagships – Solar Dawn Project
Solar Hot Water Rebate Scheme	Smart Energy Savings Program
Solar Atlas	Sustainable Industries' Cluster programs
Cloncurry Solar Thermal Trial Site Remediation	Sustainable Industry Associations program
Bright Thing Campaign	

4.6.3 Building standard measures impacting energy consumption

6-Star Building Energy Efficiency Rating[9]

The Building Code of Australia[10], in conjunction with the Queensland Development Code, introduced a 6-star building standard for new houses, townhouses and renovations. The 6-star standard has applied to the construction of these new Queensland residences since May, 2010. However, new or existing multi-unit residential buildings remain to be required to only achieve at least a 5-star standard.

The 6-star standard represents the minimum energy efficiency standard out of a potential 10 star rating using the Nationwide House Energy Rating Scheme (NatHERS). The rating is designed to improve the 'building shell' or thermal performance of a building. This can be done by considering energy efficiency improvements to the design of the roof, walls, windows and floors.

Potential design measures can include passive features, such as considering the buildings orientation toward the sun, maximising house ventilating by having windows within breeze paths and roof ventilation, or by installing insulation in the walls or ceiling.

The Queensland Development Code also allows for 'optional credits' to contribute toward a total 6-star rating. The house or townhouse is still required to achieve a baseline star rating, which differs depending on the residence climate zone.

The optional credits are allowed for the following flexible design features:

- a half star for a fully covered outdoor living area attached to an indoor area. The credit increases to a 1 star if the outdoor area includes a ceiling fan; and
- one star for installing a photovoltaic (PV) system with a minimum capacity of 1kW.

9 http://www.hpw.qld.gov.au/SiteCollectionDocuments/SixStarEnergyEfficiencyRatingFactSheet.pdf.

10 Now the *National Construction Code*.

Applying a 6-star rating will increase the upfront cost of construction but will reduce the energy use of heating and cooling. However, there are potential offsetting factors that could reduce the benefit of the building code efficiency improvements[11].

These include non-compliance with building standards. New houses designed under more stringent building codes often do not meet the intended target star rating. The theoretical energy use savings are therefore less than originally planned. The improvements are also offset by increases in net space conditioned area, higher comfort levels demanded, and higher intensity energy use in newer homes.

Electric hot water replacement[12]

The federal government commenced a phase-out of electric hot water heaters from Australian households in December 2010. All States and Territories with the exception of Tasmania agreed to implement changes that require households to replace their electric hot water heaters with more energy efficient, less carbon intensive systems. Alternative replacement technologies include gas, solar and heat pump systems. Individual states and territories are responsible for implementing regulations, so there were jurisdictional differences in approach.

From March 2006, Queensland required that all new houses and townhouses were to install energy efficient hot water systems. The requirements were expanded in January 2010 to include households with access to a gas network. However, these households were only required to install an efficient hot water system when the old electric system needed replacement.

As of February 2013, the state government is no longer supporting the phase-out of electric hot water systems. Replacement is now on a voluntary basis, and consumers can choose to install an electric hot water system.

Queensland previously offered rebates through the Solar Hot Water Rebate Scheme until June 2012 that offered a financial incentive for replacement with solar or heat pump hot water systems. The federal government still offers financial incentives for renewable systems that are available to Queensland households from Small-scale Technology Certificates through the Renewable Energy Target scheme.

Energy efficient lighting[13]

The Queensland Development Code regulates the installation of lighting in newly constructed residential buildings. Houses, townhouses and units must choose to install either a minimum of 80 per cent of lighting fixtures with efficient lighting, or alternatively install lighting based on minimum watts per square metre. The regulations also apply to the areas of existing homes which undergo renovations.

Energy efficiency is based on a minimum light produced per watt of electricity. This for example allows for the installation of Compact Fluorescent Lights (CFLs), Light Emitting Diodes (LEDs) and can include more efficient halogen downlights.

The federal government has restricted the sale and import of inefficient incandescent light bulbs since 2009. Sales restrictions of other inefficient light bulbs have proceeded over subsequent stages and changes continue to be implemented toward more regulated energy efficient lighting solutions.

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11 Details are included in *The Evaluation of the 5-Star Energy Efficiency Standard for Residential Buildings: Final Report (2013), CSIRO.*

12 http://www.hpw.qld.gov.au/construction/Sustainability/SustainableHousingLaws/Pages/ElectricHotWaterSystem Replacement.aspx.

13 http://www.hpw.qld.gov.au/SiteCollectionDocuments/EnergyEfficientLighting.pdf.

4.6.4 National policy measures

This section summarises a selection of National Policies that affect Queensland energy sales and demand.

Renewable Energy Target (RET) Scheme

The national Renewable Energy Target (RET) scheme aims to have the equivalent of 20 per cent of Australia's electricity come from renewable sources by 2020, which is currently predicted and fixed in legislation to be 41,000 GWh. The RET operates under two parts:

- the Large-scale Renewable Energy Target (LRET); and
- the Small-scale Renewable Energy Scheme (SRES).

These schemes create financial incentives for investment in renewable technologies through the creation and sale of renewable energy certificates. Certificates are created through investment in electricity generated by power stations, or small-scale solar panels, wind or hydro systems. They are also created through the electricity displaced by the installation of a solar water heater or heat pump.

On 17 February 2014, the government announced a review of the RET by an expert panel. The review is to ensure the scheme is operating efficiently and effectively. In the Government's Terms of Reference, the expert panel is expected to provide advice on:

- whether the objective of the RET scheme, to deliver 41,000 gigawatt hours (GWh) and small scale solar generation by 2020, is still appropriate;
- the extent of the RET's impact on electricity prices, and the range of options available to reduce any impact while managing sovereign risk;
- the operation of the small-scale and large-scale components of the RET and their interaction;
- implications of projected electricity demand for the 41,000 (GWh) target; and
- implementation arrangements for any proposed reforms to the RET, including how to manage transition issues, risks and any adjustment costs that may arise from policy changes to the RET.

Source: https://www.dpmc.gov.au/consultation/review_RET/ToR.cfm.

A report to the Prime Minister and the Ministers for Industry and the Environment is due in mid-2014.

Energy performance standards for appliances and products

Improving the energy efficiency of appliances and products has significant economic and environmental benefits for Australia by reducing greenhouse gas emissions and energy sales and demands. Energy efficiency improvement reduces the running costs of appliances and products for households and businesses thereby increasing energy productivity.

Up until October 2012, the main policy tools used to achieve reductions in energy use from these products were mandatory **Minimum Energy Performance Standards** (MEPS) and **Energy Rating Labels** (ERLs) which were first developed and implemented in the 1990s and steadily upgraded and extended to a greater range of appliances and products. Since October 2012, Australia's **Greenhouse and Energy Minimum Standards** (GEMS) legislation has commenced under the Equipment Energy

Efficiency (E3) program.[14] Under the new legislation, the Australian GEMS Regulator will replace state regulators in enforcing regulations and creates a national framework by replacing seven overlapping pieces of state legislation within the Equipment Energy Efficiency (E3) framework. This framework aims to provide enhanced monitoring, verification and enforcement and allows the scope of the previous energy efficiency improvement initiatives to be expanded.

While there have been improvements in energy efficiency of many residential buildings and household technologies (refrigerators, furnaces, air conditioners, etc.) over the last 40 years, many efficiency gains have been offset by preferences for larger houses, increased air conditioning use and market penetration of a greater variety of new appliances and electronics. Hence, unless residential customers are actively engaged in more proactive home energy management activities, efforts to reduce household energy consumption will be constrained. That is, expansions of appliance and equipment energy use activities can more than offset energy efficiency improvement gains.

Currently, regulatory requirements for air conditioners and heat pumps are set under the GEMS Determination 2013, with this Determination coming into force from 1 April 2014. This Determination will regulate multi-split air conditioners and heat pumps for the first time by calling up requirements set out in AS 3823.2-2013. This continues on from more stringent MEPS that were introduced in 2011 and 2012.

Clean Technology Investment Program

The Clean Technology Investment Program was a part of the Australian Government's Clean Energy Future plan announced in July 2011. The plan provided transitional assistance for businesses and industry through the $8.6 billion Jobs and Competitiveness Program, the $1.2 billion Clean Technology Program, the $300 million Steel Transformation Plan and the $1.3 billion Coal Sector Jobs Package. The Clean Technology Investment Program was an $800 million competitive, merit-based grants program to support Australian manufacturers to maintain competitiveness in a carbon constrained economy. This program provided grants for investments in energy efficient capital equipment and low emission technologies, processes and products.

The Clean Technology Investment Program was discontinued in 2013 as a part of the Federal government’s plan to repeal the carbon tax in July 2014. Over the duration of the program Queensland manufacturers received around $51 million in grants, a third of the grants for manufacturers within the Ergon region and two thirds within ENERGEX[15].

Table 4.8 summarises a selection of the largest grant recipients in Queensland.

[14] E3 is a joint initiative of the Australian Commonwealth, State and Territory Governments and the New Zealand Government.

[15] http://www.ausindustry.gov.au/programs/CleanTechnology/Documents/granteeList.xls.

Table 4.8	Summary of large recipients of Clean Technology Investment Program grants		
Applicant	**Industry sector**	**Energy efficiency or emissions reduction measure**	**Area**
Wagners Queensland Pty Ltd	Cement, Lime, Plaster and Concrete Product Manufacturing	Replacement Equipment	ENERGEX
Mackay Sugar Limited	Sugar Manufacturing	Switching To Bagasse	Ergon
A.J. Bush & Sons (Manufactures) Pty Ltd	Meat, poultry and small goods manufacturing	Switching To Biogas	ENERGEX
JBS Australia Pty Limited	Meat, poultry and small goods manufacturing	Switching to Biogas	ENERGEX
Teys Australia Meat Group Pty Ltd ATF the Consolidated Meat Processors Unit Trust	Meat, poultry and small goods manufacturing	Switching to Biogas	Ergon
Boral Bricks Pty Ltd	Ceramic Product Manufacturing	Replacement Equipment	ENERGEX
Teys Australia Beenleigh Pty Ltd	Meat, poultry and small goods manufacturing	Switching to Biogas	ENERGEX
Downer EDI Works Pty Ltd	Petroleum and Coal Product Manufacturing	Replacement Equipment	ENERGEX
Coca-Cola Amatil Limited	Non alcoholic beverages manufacturing	Replacement Equipment	ENERGEX
Greenmountain Food Processing Pty Ltd	Meat, poultry and small goods manufacturing	Refrigeration Upgrade	ENERGEX
Bundaberg Sugar Ltd	Sugar Manufacturing	Switching To Bagasse	Ergon
King Springworks Pty Ltd	Iron and steel casting and forging	Switching to Natural Gas	ENERGEX
Greenmountain Food Processing Pty Ltd	Meat, poultry and small goods manufacturing	Other	ENERGEX
Wagners CFT Manufacturing Pty Ltd	Glass and glass product manufacturing	Replacement Equipment	Ergon
Bestlan Bananas Pty Ltd	Fruit and vegetable processing	Replacement Equipment	Ergon
Resitech Industries Pty Ltd AFT Resitech Industries Trust	Polymer Product Manufacturing	Replacement Equipment	ENERGEX
Global Roto-Moulding Pty Ltd	Polymer Product Manufacturing	Replacement Equipment	ENERGEX
RL Adams Pty Ltd	Meat, poultry and small goods manufacturing	Switching to Biogas	Ergon
Andpak (Aust) Pty Ltd ATF the Andpak (Aust) Unit Trust	Polymer Product Manufacturing	Replacement Equipment	Ergon
D.T.R. Holdings Pty Ltd	Fruit and vegetable processing	Refrigeration Upgrade	ENERGEX

4.6.5 Retail and network campaigns and tariff innovations

The following tables summarise the key tariff innovations, trials and campaigns that have an impact on the Ergon network.

Table 4.9 Retail and network tariff innovations

Innovation	Description
Pool pump off-peak Tariff 33	From July 1 2011, the tariff schedule in the Queensland Government Gazette and the *Electricity Industry Code* was amended to allow domestic pool owners to connect pool pumps to Tariff 33 via a standard power point. There are more than 300,000 homes in Queensland with swimming pools, and around 10,000 new pools are constructed each year. Of these existing pools, more than half are connected to Tariff 11 which contributes around 163 megawatts each year to peak electricity load. Pool filtration systems required a permanent hard wire connection to the home's electricity system to be eligible for Tariff 33 (a cheaper off-peak tariff). This meant that pool owners needed to pay a licensed electrician to disconnect and reconnect the pool pump for all pump repairs or maintenance.
Residential Time of use (Tariff 12)[16]	From 1 July 2012, a new voluntary time-of-use tariff became available to residential and small business electricity customers. Customers who have a meter capable of measuring consumption at different times of the day can access this tariff. Customers on this tariff pay different rates for electricity consumed at different times of the day. Electricity consumed during off peak and shoulder times is less expensive than electricity consumed during the peak period (4pm-8pm Monday to Friday).
Residential Time of use (Tariff 13 – Peak Smart)[17]	The new time-of-use "peak smart" network tariff (7600) commenced in July 2013 for residential customers in ENERGEX and Ergon networks. This tariff is designed for customers with "Demand Response Ready" appliances, such as air conditioners, which allow the distributor to control the appliance for the purposes of managing peak network demand. In return, customers on this new tariff would receive a lower off-peak network charge relative to that for Tariff 12. The new tariff is otherwise similar to the time-of-use network tariff (8900) that is the basis for the existing residential time-of-use tariff, Tariff 12.
Cost-reflective pricing	Legislative changes in late 2011 changed the way the QCA is required to determine regulated prices (which was began with in 2012-13 determination except Tariff 11 which was set by the Energy Minister). Instead of escalating all existing retail tariffs (most of which were introduced over 20 years ago) by the same percentage each year as it had previously been required to do, the QCA is now required to establish a new set of retail tariffs which better reflected the costs of supply. The QCA has identified a number of issue include the rebalancing of the fixed and variable components to cost reflective levels by 1 July 2015 for the standard residential tariff (Tariff 11). The fixed charge under Tariff 11 for 2012-13 is 26.17c/day, which is significantly lower than the cost reflective level of 78.578c/day. In contrast, the variable charge under Tariff 11 is 23.071c/kWh, which is higher than the cost reflective level of 20.134c/kWh. The move to cost-reflective tariff could lead to increases in electricity bills for some households (notably consumer that consume less than 6,500 kWh per annum).

[16] https://www.ergon.com.au/your-home/electricity-prices/time-of-use-tariffs.

[17] http://www.dews.qld.gov.au/energy-water-home/electricity/prices/tariffs-explained.

Table 4.10	ENERGEX trials and campaigns
Campaigns	**Details**
Positive Payback[18]	The program contributes to the management of peak system demand for ENERGEX by offering rewards and incentives to consumers. These measures effectively reduce demand from residential customers, who receive a one off payment from $100 to $500 dependent on the activity. ENERGEX offers various rewards for the installation of a PeakSmart air-conditioner, connecting a hot water system or a pool pump to an economy tariff, or for the installation of an energy efficient pool pump. ENERGEX also offers funding assistance to businesses who implement projects that will reduce energy demand. Examples of recently completed projects include upgrading lighting of the businesses property or upgrading space conditioning to more energy efficient alternatives.
Tariff trial[19]	The tariff trial is a co-operative project between Queensland's two electricity distributors – Ergon Energy and ENERGEX. The trial is a theoretical study and will not affect normal electricity bills. The tariff trial will help understand if customers are able, or prepared, to shift their electricity usage from peak to off-peak periods if we reward them for doing so. The trial will provide valuable information about a pricing system that rewards customers who voluntarily change the way they use electricity. The trial ran from January 2011 to March 2013 with a final report due to be published in 2014. The trial occurred in three locations across Queensland – Cairns, Toowoomba and Brisbane. During the trial customers are encouraged to adjust their electricity usage in response to theoretical prices. This theoretical pricing is linked to the domestic flat rate electricity price that most households in Queensland pay for their electricity – commonly referred to as Tariff 11.

[18] https://www.energex.com.au/sustainability/rewards-for-air-conditioning-pools-and-hot-water.

[19] http://www.ergon.com.au/energy-conservation/demand-management/electricity-demand-trials/tariff-trial.

5. ENERGEX distribution area electrical energy forecasts to 2025

This section presents electricity demand forecasts by class and electricity sent out for the ENERGEX distribution area region to 2025. Three scenarios were developed, a base, high and low growth scenario.

5.1 Electricity sales by customer class

The base scenario

Under the base scenario, ENERGEX distribution area gross regional product grows by 3.6 per cent in average terms between 2015 and 2025. Population growth averages 2.2 per cent per annum over the same period.

Table 5.1 shows electricity sales projections by major class for the ENERGEX distribution area to 2025. Figures 5.1 to 5.4 show the projection for each major class to 2025. Table 5.3 shows an industry breakdown of total business sales in the ENERGEX distribution area. As outlined in Section 4, ASIC based industry electricity projections drive the total ENERGEX distribution area business sales forecast.

Total electricity sales in the ENERGEX region fell 1.1 per cent in 2011-12 and 0.7 per cent in 2012-13, partly reflecting the impact of real electricity price increases as well as the impact on new PV systems. Total sales fell by some 3.0 per cent in 2010-11.

Residential sales fell by 4.7 per cent in 2010-11, while commercial sales fell by 2.9 per cent. Residential sales have been falling by between 2.5 and 4.0 per cent per annum since 2011. Industrial sales in the ENERGEX region have been declining by a similar percentage since 2012. Total electricity sales growth averages 2.0 per cent per year over the 2015 to 2025 period under the base scenario.

An important factor dampening sales growth in the residential sector since 2010 has been the rapid increase in small scale solar PV systems. The rapid increase in these PV systems has been stimulated by:

- reduced capital costs, given eligibility for RECs;
- attractive feed-in-tariff schemes; and
- falling capital costs of PV systems and, in particular, solar panels.

Table 5.5 shows projections for small scale PV for the ENERGEX region. By 2014-15, it is estimated that there will be 296,296 systems installed, with a nameplate capacity of some 749 MW. Displaced energy sales by 2014-15 are some 1,165 GWh. By 2019-20, displaced energy or in-house use is some 2,291 GWh.

This projection assumes the continued popularity associated with PV installations continues with another 36,000 installations in 2014-15 and 47,000 in 2015-16. By 2024-25 there are around 651,415 PV customers in the ENERGEX region, or around 41 per cent of all residential customers. This may not be the case. The projected outlook for PV is a key uncertainty associated with the ENERGEX forecasts.

Another factor dampening sales growth has been large real electricity price increases. In 2011-12, real residential electricity prices are some 33 per cent higher than the level prevailing in 2007-08.

Residential sales are projected to continue to fall through to 2018-19, initially reflecting the impact of high electricity prices and continued very high small scale PV installation activity. Carbon is removed from 2014-15.

The main movements by class in the base scenario are as follows.

- Residential sales account for around 36 per cent of total electricity sales by ENERGEX. Residential sales fell by 4.7 per cent in 2010-11. Higher electricity prices, the rapid penetration of small scale PV systems and the Queensland floods in January 2011 contributed to this outcome. Residential sales fall further and remain flat to 2018-19. Sales fall by 3.9 per cent in 2014-15 and 3.3 per cent in 2015-16 in the ENERGEX distribution area. Residential sales growth in the ENERGEX region resumes in 2019-20.

  The main uncertainty regarding the residential sales forecast is the outlook for PV installations. In this projection, the share of PV in total residential customers reaches 41 per cent by 2024-25. The possibility of new FIT schemes cannot be discounted.

  Residential sales over recent years have been supported by high levels of dwelling construction in the ENERGEX distribution area as well as continued high sales of space cooling equipment. As 80 per cent of AC equipment is reverse cycle, this equipment has also contributed to winter loads.

  Overall, residential electricity sales in the ENERGEX distribution area averages -0.3 per cent growth per annum between 2015 and 2025.

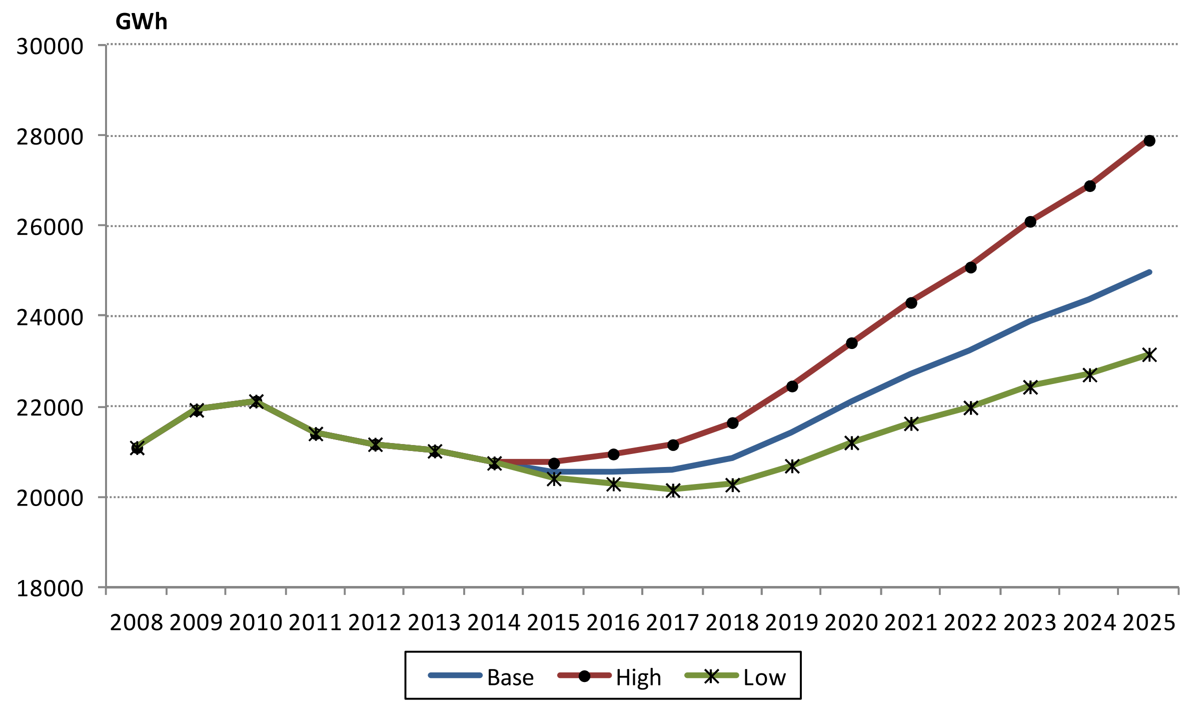
  The Federal Government has banned resistance hot water from 2010.

- Total business sales represent around 62 per cent of total ENERGEX electricity sales. In this forecast by NIEIR, business sales are split between commercial and industrial sales. Commercial sales are around 47 per cent of total ENERGEX sales while industrial sales are around 15 per cent of ENERGEX sales.

- The profile for commercial and industrial sales over the forecast period generally follows the overall profile for projected GSP growth, but is partly influenced by the price increases induced by the price on carbon from 2012-13 and its subsequent removal. Total commercial sales growth averages 3.8 per cent per annum between 2015 and 2025. Industrial sales grow by 0.2 per cent over the same period. More detailed ASIC electricity sales forecasts are provided in Tables 5.3 and 5.4.

- Public lighting electricity sales are linked to general population growth. Public lighting is forecast to average 3.4 per cent growth per annum over the same period.

Figure 5.1: ENERGEX electricity sales by class – total



Forecasts of customer numbers by class for the ENERGEX region are presented in Table 5.2.

Figure 5.2: ENERGEX electricity sales by class – residential

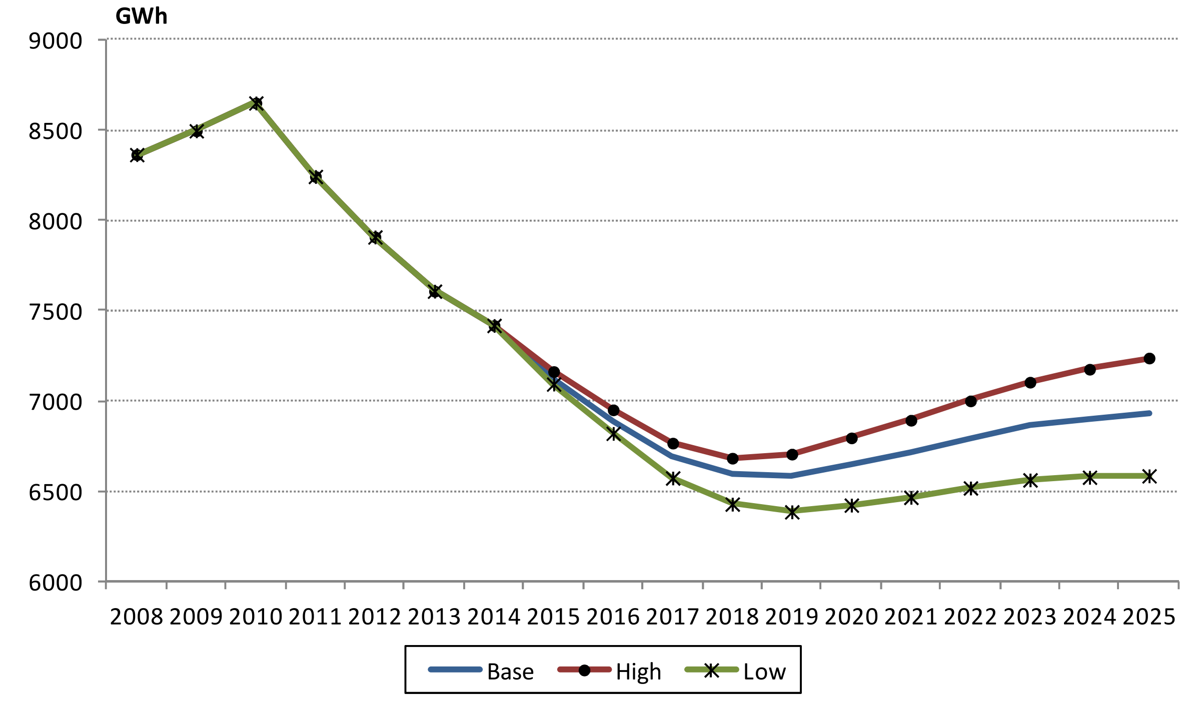


Figure 5.3: ENERGEX electricity sales by class – commercial

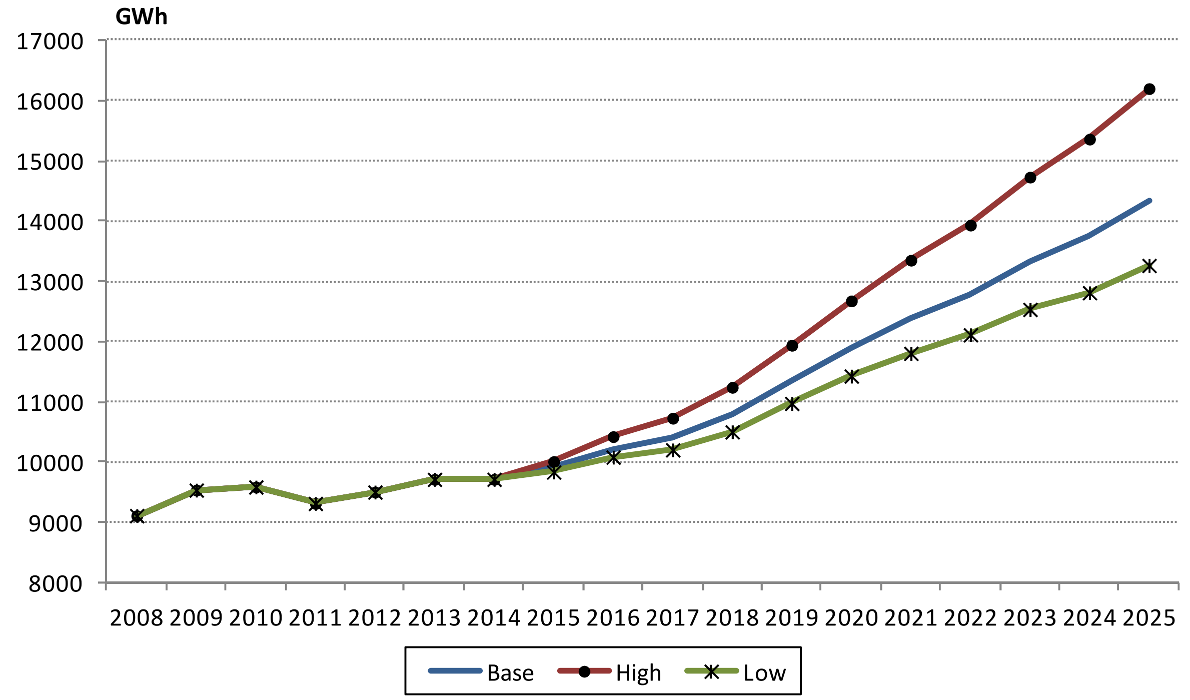


Figure 5.4: ENERGEX electricity sales by class – industrial

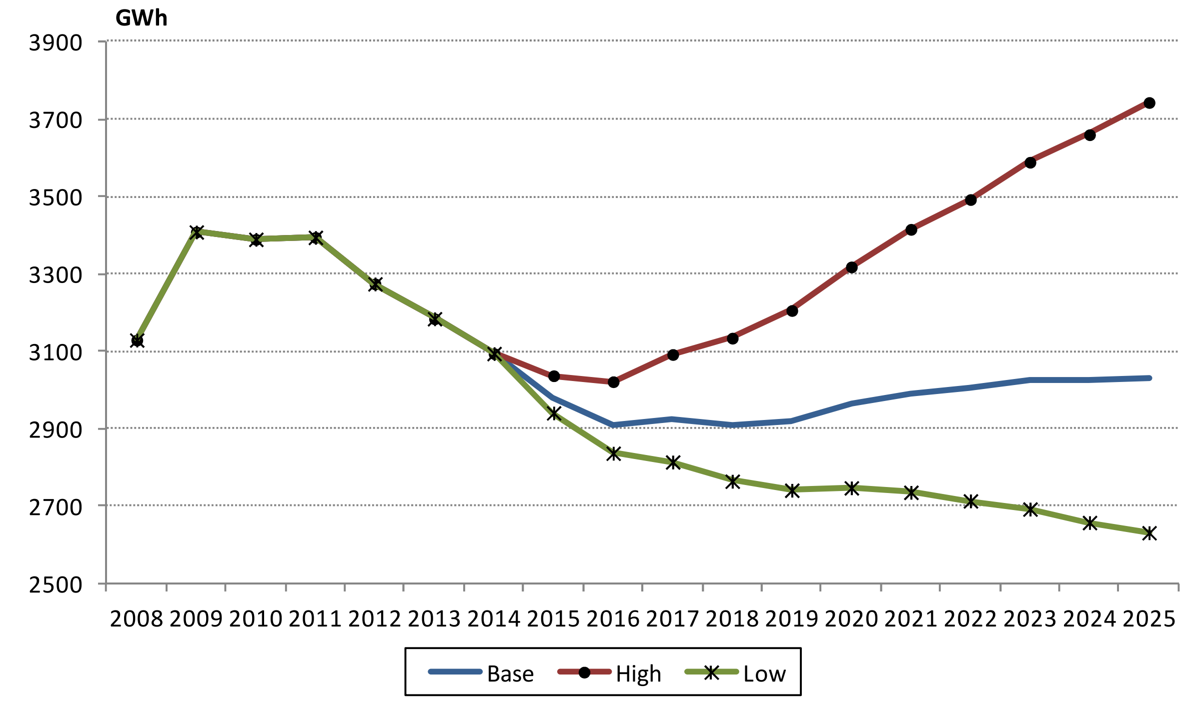


Figure 5.5: Small scale PV – ENERGEX – Total installed capacity

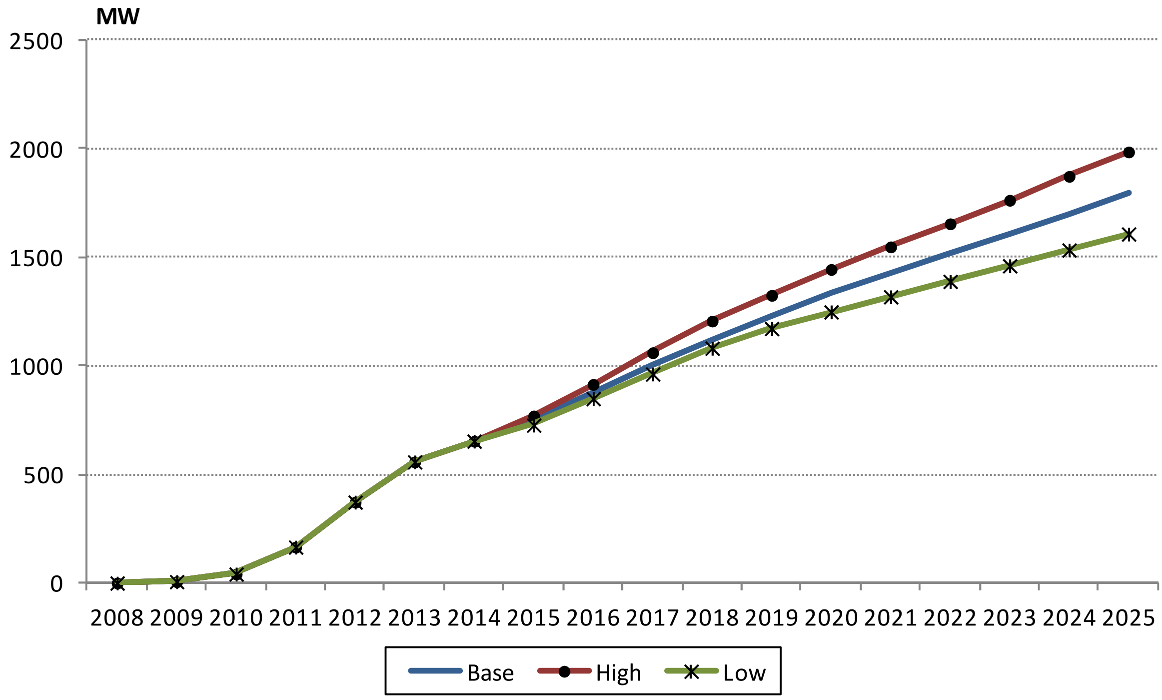
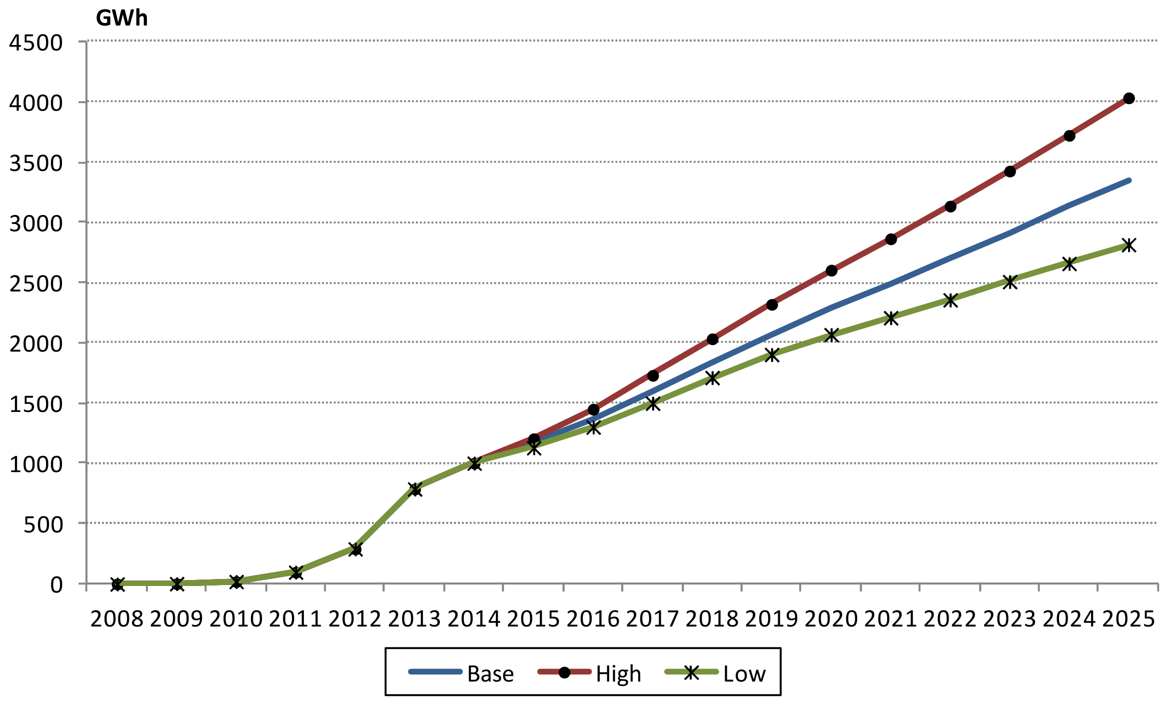


Figure 5.6: Small scale PV – ENERGEX – In-house usage



The high scenario

Under the high growth scenario, ENERGEX's gross regional product increases by an average annual rate of 5.0 per cent between 2015 and 2025. Population growth averages 2.5 per cent per annum over the same period. The high scenario assumes that ENERGEX distribution area also secures a larger share of national private investment, hence manufacturing output growth is higher in ENERGEX distribution area relative to the base scenario.

The key features of the high scenario in terms of electricity sales are:

- total electricity sales growth averaging 3.0 per cent per annum between 2015 and 2025, 1.0 percentage point above the base scenario;
- average residential sales growth of 0.1 per cent per annum between 2015 and 2025, reflecting stronger dwelling formation but the impact of PV;
- commercial sales growth averaging 4.9 per cent per annum between 2015 and 2025, 1.1 percentage point above the average base projection; and
- industrial sales growth of 2.1 per cent per annum on average between 2015 and 2025, partly reflecting more rapid growth in energy intensive industries.

The low scenario

Under the low scenario, ENERGEX's gross regional product increases at an average annual rate of 2.8 per cent, 0.8 percentage points below the base projection. Average annual population growth between 2015 and 2025 is 2.0 per cent per annum, 0.2 percentage points below the base scenario.

The key features of the low scenario in terms of electricity sales are:

- average annual residential sales fall by 0.7 per cent per annum between 2015 and 2025, reflecting slower growth in the dwelling stock and the impact of PV;
- comparatively slow growth in commercial sales, which average 3.0 per cent per annum between 2015 and 2025, 0.8 percentage points below the average growth under the base scenario;
- industrial sales falling by an average of 1.1 per cent per annum, reflecting much weaker manufacturing output for ENERGEX; and
- total average sales growth across all classes of 1.3 per cent between 2015 and 2025, 0.7 percentage points below the base projection.

TABLE 5.1 Electricity Sales by class - ENERGEX Region

	Residen-ial	Commercial	Industrial	Farm	Traction	Public Lighting	Total	Total Inc Embedded PV
Unit	GWH							
BASE								
2010	8652.00	9594.00	3390.00	150.00	185.00	159.00	22130.00	22150.39
2011	8245.00	9320.00	3395.00	90.00	197.00	165.00	21412.00	21510.21
2012	7910.00	9510.00	3275.00	100.00	210.00	170.00	21175.00	21466.22
2013	7610.00	9720.00	3185.00	120.00	216.42	175.88	21027.30	21815.84
2014	7420.00	9720.00	3095.00	120.00	223.44	182.19	20760.63	21763.95
2015	7130.18	9907.06	2980.24	117.22	231.39	189.11	20555.20	21720.62
2016	6892.82	10216.29	2910.83	114.84	239.61	196.28	20570.67	21939.09
2017	6688.19	10404.49	2923.55	112.90	247.84	203.57	20580.54	22175.56
2018	6594.87	10782.84	2908.16	112.51	255.95	210.91	20865.24	22698.07
2019	6588.61	11336.02	2919.90	112.75	264.20	218.44	21439.91	23504.26
2020	6644.77	11894.54	2964.56	114.07	272.76	226.27	22116.97	24407.73
2021	6710.12	12378.68	2991.80	115.26	281.56	234.36	22711.77	25201.35
2022	6787.44	12784.73	3003.82	116.00	289.32	242.00	23223.32	25918.70
2023	6861.08	13341.31	3023.16	116.58	295.44	248.84	23886.40	26797.43
2024	6902.35	13744.72	3023.21	116.62	302.48	256.32	24345.70	27473.58
2025	6935.11	14332.21	3032.68	117.29	311.74	265.20	24994.24	28348.46
Percentage changes								
2011	-4.70	-2.86	0.15	-40.00	6.49	3.77	-3.24	-2.89
2012	-4.06	2.04	-3.53	11.11	6.60	3.03	-1.11	-0.20
2013	-3.79	2.21	-2.75	20.00	3.06	3.46	-0.70	1.63
2014	-2.50	0.00	-2.83	0.00	3.24	3.59	-1.27	-0.24
2015	-3.91	1.92	-3.71	-2.31	3.56	3.80	-0.99	-0.20
2016	-3.33	3.12	-2.33	-2.03	3.55	3.79	0.08	1.01
2017	-2.97	1.84	0.44	-1.69	3.44	3.72	0.05	1.08
2018	-1.40	3.64	-0.53	-0.35	3.27	3.61	1.38	2.36
2019	-0.09	5.13	0.40	0.21	3.22	3.57	2.75	3.55
2020	0.85	4.93	1.53	1.18	3.24	3.58	3.16	3.84
2021	0.98	4.07	0.92	1.04	3.23	3.57	2.69	3.25
2022	1.15	3.28	0.40	0.64	2.76	3.26	2.25	2.85
2023	1.08	4.35	0.64	0.50	2.11	2.83	2.86	3.39
2024	0.60	3.02	0.00	0.04	2.38	3.01	1.92	2.52
2025	0.47	4.27	0.31	0.57	3.06	3.46	2.66	3.18
Compound growth rate (per cent) -								
2010-2015	-3.80	0.64	-2.54	-4.81	4.58	3.53	-1.47	-0.39
2015-2020	-1.40	3.72	-0.11	-0.54	3.34	3.65	1.48	2.36
2015-2025	-0.28	3.76	0.17	0.01	3.03	3.44	1.97	2.70

TABLE 5.1 Electricity Sales by class - ENERGEX Region (continued)

	Residen-ial	Commercial	Industrial	Farm	Traction	Public Lighting	Total	Total Inc Embedded PV
Unit	GWH							
HIGH - Levels								
2015	7164.84	10014.78	3037.91	117.56	232.33	189.62	20757.04	21963.38
2016	6952.81	10429.31	3022.44	115.47	241.46	197.30	20958.78	22409.94
2017	6768.47	10735.13	3092.74	113.84	250.64	205.11	21165.93	22897.88
2018	6685.17	11247.32	3134.91	113.78	259.65	212.95	21653.79	23689.12
2019	6707.58	11944.74	3206.27	114.32	269.11	221.16	22463.19	24784.73
2020	6797.65	12681.13	3318.90	116.04	278.84	229.64	23422.20	26027.27
2021	6895.27	13355.63	3415.93	117.62	288.86	238.42	24311.73	27177.33
2022	7002.38	13937.96	3492.93	118.70	297.76	246.71	25096.44	28233.44
2023	7105.93	14733.76	3589.18	119.72	304.89	254.14	26107.63	29535.49
2024	7177.62	15364.27	3660.30	120.16	313.07	262.30	26897.73	30621.92
2025	7239.77	16202.53	3743.39	121.21	323.72	271.98	27902.60	31938.03
Percentage changes								
2015	-3.44	3.03	-1.84	-2.03	3.98	4.08	-0.02	0.88
2016	-2.96	4.14	-0.51	-1.78	3.93	4.05	0.97	2.03
2017	-2.65	2.93	2.33	-1.41	3.80	3.96	0.99	2.18
2018	-1.23	4.77	1.36	-0.05	3.59	3.82	2.30	3.46
2019	0.34	6.20	2.28	0.48	3.64	3.85	3.74	4.62
2020	1.34	6.17	3.51	1.50	3.61	3.84	4.27	5.01
2021	1.44	5.32	2.92	1.36	3.59	3.82	3.80	4.42
2022	1.55	4.36	2.25	0.92	3.08	3.48	3.23	3.89
2023	1.48	5.71	2.76	0.86	2.39	3.01	4.03	4.61
2024	1.01	4.28	1.98	0.37	2.68	3.21	3.03	3.68
2025	0.87	5.46	2.27	0.87	3.40	3.69	3.74	4.30
Compound growth rate (per cent) -								
2015-2020	-1.05	4.83	1.79	-0.26	3.72	3.90	2.45	3.45
2015-2025	0.10	4.93	2.11	0.31	3.37	3.67	3.00	3.82
LOW - Levels								
2015	7095.30	9841.15	2941.85	116.97	230.72	188.74	20414.72	21545.27
2016	6822.56	10088.78	2837.83	114.37	238.23	195.52	20297.30	21600.17
2017	6575.37	10209.01	2815.11	112.20	245.81	202.45	20159.96	21660.65
2018	6430.85	10508.53	2765.41	111.56	253.02	209.29	20278.66	21991.94
2019	6388.01	10979.06	2742.19	111.57	260.41	216.34	20697.59	22602.33
2020	6425.26	11434.01	2748.28	112.61	268.08	223.66	21211.90	23281.84
2021	6468.30	11809.76	2736.78	113.50	276.04	231.27	21635.65	23845.64
2022	6520.27	12117.87	2714.63	113.99	283.04	238.46	21988.26	24346.79
2023	6564.71	12539.04	2693.63	114.25	288.35	244.82	22444.79	24954.82
2024	6579.54	12816.24	2658.66	114.00	294.43	251.73	22714.60	25374.99
2025	6587.32	13268.17	2632.41	114.38	302.68	260.00	23164.96	25981.49
Percentage changes								
2015	-4.38	1.25	-4.95	-2.53	3.26	3.59	-1.67	-0.99
2016	-3.84	2.52	-3.54	-2.22	3.26	3.60	-0.58	0.25
2017	-3.62	1.19	-0.80	-1.89	3.18	3.54	-0.68	0.28
2018	-2.20	2.93	-1.77	-0.57	2.93	3.38	0.59	1.53
2019	-0.67	4.48	-0.84	0.01	2.92	3.37	2.07	2.78
2020	0.58	4.14	0.22	0.93	2.95	3.39	2.48	3.01
2021	0.67	3.29	-0.42	0.80	2.97	3.40	2.00	2.42
2022	0.80	2.61	-0.81	0.43	2.53	3.11	1.63	2.10
2023	0.68	3.48	-0.77	0.23	1.88	2.67	2.08	2.50
2024	0.23	2.21	-1.30	-0.22	2.11	2.82	1.20	1.68
2025	0.12	3.53	-0.99	0.34	2.80	3.29	1.98	2.39
Compound growth rate (per cent) -								
2015-2020	-1.96	3.05	-1.35	-0.76	3.05	3.45	0.77	1.56
2015-2025	-0.74	3.03	-1.11	-0.22	2.75	3.26	1.27	1.89

All data are for the financial year ending in June of the year specified.

TABLE 5.2 Electricity Customers by class - ENERGEX Region

	Residen-ial	Commercial	Industrial	Farm	Traction	Public Lighting	Total
Unit	************************		Number	********************************			
BASE							
2010	1187768.00	100814.00	3829.00	6655.00	9.00	19260.00	1318335.00
2011	1204162.00	101733.00	3820.00	6400.00	10.00	19260.00	1335385.00
2012	1220365.00	103100.00	3830.00	6315.00	10.00	19260.00	1352880.00
2013	1235740.00	101487.00	3848.00	6110.00	10.00	19260.00	1366455.00
2014	1251740.00	100600.00	3835.00	5890.00	10.00	19260.00	1381335.00
2015	1275359.13	101893.08	3824.81	5861.11	10.00	19260.00	1406208.13
2016	1305562.13	104013.13	3818.75	5835.89	10.00	19260.00	1438499.88
2017	1339624.25	105293.03	3819.38	5815.06	10.00	19260.00	1473821.63
2018	1375830.13	107843.25	3817.34	5810.79	10.00	19260.00	1512571.50
2019	1410834.38	111519.32	3818.47	5813.38	10.00	19260.00	1551255.63
2020	1443040.50	115171.35	3821.92	5827.66	10.00	19260.00	1587131.38
2021	1473485.63	118291.44	3824.41	5840.36	10.00	19260.00	1620711.88
2022	1503310.38	120877.36	3824.89	5848.19	10.00	19260.00	1653130.88
2023	1529810.00	124378.27	3826.68	5854.35	10.00	19260.00	1683139.25
2024	1551878.88	126885.68	3826.00	5854.79	10.00	19260.00	1707715.25
2025	1574560.75	130494.28	3826.89	5861.82	10.00	19260.00	1734013.75
Percentage changes							
2011	1.38	0.91	-0.24	-3.83	11.11	0.00	1.29
2012	1.35	1.34	0.26	-1.33	0.00	0.00	1.31
2013	1.26	-1.56	0.47	-3.25	0.00	0.00	1.00
2014	1.29	-0.87	-0.34	-3.60	0.00	0.00	1.09
2015	1.89	1.29	-0.27	-0.49	0.00	0.00	1.80
2016	2.37	2.08	-0.16	-0.43	0.00	0.00	2.30
2017	2.61	1.23	0.02	-0.36	0.00	0.00	2.46
2018	2.70	2.42	-0.05	-0.07	0.00	0.00	2.63
2019	2.54	3.41	0.03	0.04	0.00	0.00	2.56
2020	2.28	3.27	0.09	0.25	0.00	0.00	2.31
2021	2.11	2.71	0.07	0.22	0.00	0.00	2.12
2022	2.02	2.19	0.01	0.13	0.00	0.00	2.00
2023	1.76	2.90	0.05	0.11	0.00	0.00	1.82
2024	1.44	2.02	-0.02	0.01	0.00	0.00	1.46
2025	1.46	2.84	0.02	0.12	0.00	0.00	1.54
Compound growth rate (per cent) -							
2010-2015	1.43	0.21	-0.02	-2.51	2.13	0.00	1.30
2015-2020	2.50	2.48	-0.02	-0.11	0.00	0.00	2.45
2015-2025	2.13	2.50	0.01	0.00	0.00	0.00	2.12

TABLE 5.2 Electricity Customers by class - ENERGEX Region (continued)

	Residen-ial	Commercial	Industrial	Farm	Traction	Public Lighting	Total
Unit	************************	Number	**********************************				
HIGH – Levels							
2015	1279267.38	102634.02	3830.12	5864.68	10.00	19260.00	1410866.13
2016	1313073.13	105461.20	3829.12	5842.59	10.00	19260.00	1447476.13
2017	1350860.38	107523.28	3835.01	5825.15	10.00	19260.00	1487313.75
2018	1390556.38	110933.91	3838.29	5824.50	10.00	19260.00	1530423.00
2019	1430225.13	115496.78	3844.56	5830.35	10.00	19260.00	1574666.75
2020	1466791.75	120220.20	3853.53	5848.63	10.00	19260.00	1615984.13
2021	1501686.88	124467.73	3861.52	5865.25	10.00	19260.00	1655151.38
2022	1535627.75	128078.16	3867.26	5876.53	10.00	19260.00	1692719.63
2023	1565814.00	132932.69	3874.85	5887.07	10.00	19260.00	1727778.75
2024	1592286.25	136717.69	3879.82	5891.66	10.00	19260.00	1758045.50
2025	1619714.13	141671.36	3886.14	5902.41	10.00	19260.00	1790444.00
Percentage changes							
2015	2.20	2.02	-0.13	-0.43	0.00	0.00	2.14
2016	2.64	2.75	-0.03	-0.38	0.00	0.00	2.59
2017	2.88	1.96	0.15	-0.30	0.00	0.00	2.75
2018	2.94	3.17	0.09	-0.01	0.00	0.00	2.90
2019	2.85	4.11	0.16	0.10	0.00	0.00	2.89
2020	2.56	4.09	0.23	0.31	0.00	0.00	2.62
2021	2.38	3.53	0.21	0.28	0.00	0.00	2.42
2022	2.26	2.90	0.15	0.19	0.00	0.00	2.27
2023	1.97	3.79	0.20	0.18	0.00	0.00	2.07
2024	1.69	2.85	0.13	0.08	0.00	0.00	1.75
2025	1.72	3.62	0.16	0.18	0.00	0.00	1.84
Compound growth rate (per cent) -							
2015-2020	2.77	3.21	0.12	-0.05	0.00	0.00	2.75
2015-2025	2.39	3.28	0.15	0.06	0.00	0.00	2.41
LOW - Levels							
2015	1271535.63	101438.41	3821.19	5858.42	10.00	19260.00	1401923.63
2016	1297903.38	103141.52	3811.71	5830.83	10.00	19260.00	1429957.50
2017	1328305.75	103963.46	3808.82	5807.50	10.00	19260.00	1461155.63
2018	1359910.38	105997.30	3803.21	5800.52	10.00	19260.00	1494781.38
2019	1390517.13	109154.18	3800.88	5800.61	10.00	19260.00	1528542.75
2020	1418270.25	112164.29	3800.61	5811.87	10.00	19260.00	1559317.00
2021	1444526.63	114620.73	3799.39	5821.55	10.00	19260.00	1588038.25
2022	1470395.50	116615.77	3796.38	5826.78	10.00	19260.00	1615904.38
2023	1492329.38	119315.98	3794.23	5829.56	10.00	19260.00	1640539.13
2024	1509739.50	121076.89	3789.78	5826.85	10.00	19260.00	1659703.00
2025	1527835.13	123921.05	3787.04	5830.99	10.00	19260.00	1680644.13
Percentage changes							
2015	1.58	0.83	-0.36	-0.54	0.00	0.00	1.49
2016	2.07	1.68	-0.25	-0.47	0.00	0.00	2.00
2017	2.34	0.80	-0.08	-0.40	0.00	0.00	2.18
2018	2.38	1.96	-0.15	-0.12	0.00	0.00	2.30
2019	2.25	2.98	-0.06	0.00	0.00	0.00	2.26
2020	2.00	2.76	-0.01	0.19	0.00	0.00	2.01
2021	1.85	2.19	-0.03	0.17	0.00	0.00	1.84
2022	1.79	1.74	-0.08	0.09	0.00	0.00	1.75
2023	1.49	2.32	-0.06	0.05	0.00	0.00	1.52
2024	1.17	1.48	-0.12	-0.05	0.00	0.00	1.17
2025	1.20	2.35	-0.07	0.07	0.00	0.00	1.26
Compound growth rate (per cent) -							
2015-2020	2.21	2.03	-0.11	-0.16	0.00	0.00	2.15
2015-2025	1.85	2.02	-0.09	-0.05	0.00	0.00	1.83

All data are for the financial year ending in June of the year specified.

Table 5.3 Business Electricity Consumption by Industry - ENERGEX

	Agri-culture, Forestry, Fishing & Hunting Div A	Mining Div B	Manufa-cturing Div C	Elec-tricity, Gas & Water Div D	Cons-truction Div E	Commerce-Wholesale and Retail Trade Div F	Transport, Storage, and Communi-cation Div G+H	Finance, Property and Business Services Div I	Public Admin, Defence, Community Services Div J+K	Recreation, Personal and Other Services Div L	Total Commercial Industrial Sales
Unit	GWH										
BASE											
2010	182.82	185.02	3204.98	295.36	0.00	4094.16	561.43	1684.48	1351.17	1535.18	12984.00
2011	176.44	192.00	3203.00	350.82	0.00	3944.50	530.15	1652.90	1285.12	1489.17	12715.00
2012	172.86	180.33	3094.67	368.81	0.00	4012.27	516.31	1736.09	1307.11	1504.05	12785.00
2013	168.56	173.25	3011.75	379.54	0.00	4117.90	486.07	1769.16	1353.94	1549.02	12905.00
2014	164.50	175.18	2919.82	397.93	0.00	4085.16	479.62	1799.54	1332.79	1563.16	12815.00
2015	160.69	169.30	2810.94	419.02	0.00	4176.79	481.36	1844.87	1330.21	1594.48	12887.30
2016	157.43	162.89	2747.94	431.55	0.00	4314.15	485.44	1890.08	1384.35	1651.10	13127.13
2017	154.77	169.10	2754.44	457.39	0.00	4392.16	494.42	1943.91	1386.92	1669.43	13328.04
2018	154.23	174.69	2733.47	488.64	0.00	4533.56	512.13	2037.27	1407.22	1743.85	13691.00
2019	154.56	174.81	2745.09	520.60	0.00	4796.83	546.38	2144.33	1436.44	1830.85	14255.92
2020	156.37	183.88	2780.68	554.68	0.00	5021.08	589.81	2264.29	1467.52	1935.83	14859.10
2021	158.00	185.05	2806.75	580.84	0.00	5285.38	588.95	2361.26	1480.92	2019.53	15370.47
2022	159.01	192.03	2811.79	613.27	0.00	5440.26	610.64	2457.47	1492.43	2108.72	15788.55
2023	159.81	192.49	2830.66	648.15	0.00	5714.79	631.67	2566.45	1513.47	2204.35	16364.46
2024	159.87	199.82	2823.39	682.50	0.00	5859.80	659.26	2662.86	1523.08	2294.90	16767.93
2025	160.78	199.80	2832.88	718.39	0.00	6155.76	679.61	2777.84	1539.04	2399.02	17364.90
Percentage changes											
2011	-3.49	3.77	-0.06	18.78	0.00	-3.66	-5.57	-1.88	-4.89	-3.00	-2.07
2012	-2.03	-6.08	-3.38	5.13	0.00	1.72	-2.61	5.03	1.71	1.00	0.55
2013	-2.49	-3.93	-2.68	2.91	0.00	2.63	-5.86	1.91	3.58	2.99	0.94
2014	-2.41	1.12	-3.05	4.85	0.00	-0.80	-1.33	1.72	-1.56	0.91	-0.70
2015	-2.31	-3.36	-3.73	5.30	0.00	2.24	0.36	2.52	-0.19	2.00	0.56
2016	-2.03	-3.79	-2.24	2.99	0.00	3.29	0.85	2.45	4.07	3.55	1.86
2017	-1.69	3.81	0.24	5.99	0.00	1.81	1.85	2.85	0.19	1.11	1.53
2018	-0.35	3.30	-0.76	6.83	0.00	3.22	3.58	4.80	1.46	4.46	2.72
2019	0.21	0.07	0.43	6.54	0.00	5.81	6.69	5.25	2.08	4.99	4.13
2020	1.18	5.19	1.30	6.55	0.00	4.67	7.95	5.59	2.16	5.73	4.23
2021	1.04	0.64	0.94	4.72	0.00	5.26	-0.15	4.28	0.91	4.32	3.44
2022	0.64	3.77	0.18	5.58	0.00	2.93	3.68	4.07	0.78	4.42	2.72
2023	0.50	0.24	0.67	5.69	0.00	5.05	3.45	4.43	1.41	4.53	3.65
2024	0.04	3.81	-0.26	5.30	0.00	2.54	4.37	3.76	0.63	4.11	2.47
2025	0.57	-0.01	0.34	5.26	0.00	5.05	3.09	4.32	1.05	4.54	3.56
Compound growth rate (per cent) -											
2010-2015	-2.55	-1.76	-2.59	7.24	0.00	0.40	-3.03	1.84	-0.31	0.76	-0.15
2015-2020	-0.54	1.67	-0.22	5.77	0.00	3.75	4.15	4.18	1.98	3.96	2.89
2015-2025	0.01	1.67	0.08	5.54	0.00	3.95	3.51	4.18	1.47	4.17	3.03

Table 5.3 Business Electricity Consumption by Industry – ENERGEX (continued)

	Agri-culture, Forestry, Fishing & Hunting Div A	Mining Div B	Manufa-cturing Div C	Elec-tricity, Gas & Water Div D	Cons-truction Div E	Commerce-Wholesale and Retail Trade Div F	Transport, Storage, and Communi-cation Div G+H	Finance, Property and Business Services Div I	Public Admin, Defence, Community Services Div J+K	Recreation, Personal and Other Services Div L	Total Commercial Industrial Sales
Unit	***				GWH	**					
HIGH - Levels											
2015	160.46	145.46	2892.45	411.96	0.00	4273.69	484.15	1835.05	1331.38	1602.26	13052.69
2016	157.60	140.79	2881.65	427.79	0.00	4467.84	491.13	1894.21	1398.86	1672.03	13451.74
2017	155.37	147.16	2945.58	457.59	0.00	4607.89	503.45	1964.51	1416.07	1705.13	13827.87
2018	155.29	153.10	2981.82	493.58	0.00	4819.87	525.00	2076.86	1452.28	1797.08	14382.23
2019	156.04	154.16	3052.12	530.45	0.00	5163.14	563.40	2203.21	1497.11	1901.92	15151.01
2020	158.38	163.40	3155.50	571.23	0.00	5481.48	612.55	2348.82	1547.33	2030.71	16000.03
2021	160.53	165.66	3250.27	604.51	0.00	5851.46	616.25	2472.64	1579.48	2139.03	16771.56
2022	162.01	173.04	3319.89	644.14	0.00	6100.40	643.00	2594.73	1608.20	2252.42	17430.89
2023	163.40	174.89	3414.29	688.74	0.00	6506.19	670.51	2738.38	1651.37	2379.93	18322.94
2024	164.01	183.00	3477.30	733.34	0.00	6769.61	705.13	2869.77	1681.91	2503.14	19024.58
2025	165.43	184.27	3559.12	779.54	0.00	7207.57	731.85	3020.31	1718.13	2640.48	19945.92
Percentage changes											
2015	-2.03	-2.69	-1.80	6.28	0.00	3.60	1.03	3.40	0.86	2.90	1.85
2016	-1.78	-3.21	-0.37	3.84	0.00	4.54	1.44	3.22	5.07	4.35	3.06
2017	-1.41	4.52	2.22	6.97	0.00	3.13	2.51	3.71	1.23	1.98	2.80
2018	-0.05	4.03	1.23	7.86	0.00	4.60	4.28	5.72	2.56	5.39	4.01
2019	0.48	0.69	2.36	7.47	0.00	7.12	7.31	6.08	3.09	5.83	5.35
2020	1.50	6.00	3.39	7.69	0.00	6.17	8.72	6.61	3.35	6.77	5.60
2021	1.36	1.38	3.00	5.83	0.00	6.75	0.60	5.27	2.08	5.33	4.82
2022	0.92	4.46	2.14	6.56	0.00	4.25	4.34	4.94	1.82	5.30	3.93
2023	0.86	1.07	2.84	6.92	0.00	6.65	4.28	5.54	2.68	5.66	5.12
2024	0.37	4.64	1.85	6.48	0.00	4.05	5.16	4.80	1.85	5.18	3.83
2025	0.87	0.69	2.35	6.30	0.00	6.47	3.79	5.25	2.15	5.49	4.84
Compound growth rate (per cent) -											
2015-2020	-0.26	2.35	1.76	6.76	0.00	5.10	4.82	5.06	3.05	4.85	4.16
2015-2025	0.31	2.39	2.10	6.59	0.00	5.37	4.22	5.11	2.58	5.12	4.33

Table 5.3 Business Electricity Consumption by Industry – ENERGEX (continued)

	Agri-culture, Forestry, Fishing & Hunting Div A	Mining Div B	Manufa-cturing Div C	Elec-tricity, Gas & Water Div D	Cons-truction Div E	Commerce-Wholesale and Retail Trade Div F	Transport, Storage, and Communi-cation Div G+H	Finance, Property and Business Services Div I	Public Admin, Defence, Community Services Div J+K	Recreation, Personal and Other Services Div L	Total Commercial Industrial Sales
Unit	**					GWH	***				
LOW - Levels											
2015	160.99	187.48	2754.36	418.30	0.00	4167.92	474.94	1822.27	1327.09	1575.08	12783.00
2016	157.41	179.57	2658.27	428.11	0.00	4278.59	476.85	1856.28	1373.19	1621.44	12926.61
2017	154.43	185.47	2629.64	450.65	0.00	4327.10	483.35	1897.35	1367.20	1629.07	13024.13
2018	153.55	190.59	2574.82	477.96	0.00	4435.08	498.13	1975.42	1378.09	1690.24	13273.94
2019	153.56	189.81	2552.38	505.81	0.00	4662.37	529.03	2066.65	1398.18	1763.60	13721.26
2020	154.99	198.50	2549.78	534.55	0.00	4842.69	567.99	2166.42	1418.03	1850.89	14182.29
2021	156.22	198.62	2538.16	555.17	0.00	5057.93	563.87	2242.63	1420.46	1916.47	14546.54
2022	156.89	205.07	2509.56	582.06	0.00	5171.23	581.81	2319.30	1422.45	1988.23	14832.50
2023	157.25	204.24	2489.38	609.58	0.00	5384.79	598.09	2402.33	1430.70	2061.01	15232.67
2024	156.90	210.72	2447.94	636.42	0.00	5476.35	620.58	2473.48	1428.74	2128.85	15474.91
2025	157.43	209.55	2422.86	664.69	0.00	5710.25	636.32	2562.28	1433.62	2209.58	15900.58
Percentage changes											
2015	-2.53	-3.85	-5.02	4.56	0.00	1.53	-0.14	1.86	-0.84	1.33	-0.25
2016	-2.22	-4.22	-3.49	2.35	0.00	2.66	0.40	1.87	3.47	2.94	1.12
2017	-1.89	3.29	-1.08	5.26	0.00	1.13	1.36	2.21	-0.44	0.47	0.75
2018	-0.57	2.76	-2.08	6.06	0.00	2.50	3.06	4.11	0.80	3.76	1.92
2019	0.01	-0.41	-0.87	5.83	0.00	5.12	6.20	4.62	1.46	4.34	3.37
2020	0.93	4.58	-0.10	5.68	0.00	3.87	7.36	4.83	1.42	4.95	3.36
2021	0.80	0.06	-0.46	3.86	0.00	4.44	-0.72	3.52	0.17	3.54	2.57
2022	0.43	3.25	-1.13	4.84	0.00	2.24	3.18	3.42	0.14	3.74	1.97
2023	0.23	-0.40	-0.80	4.73	0.00	4.13	2.80	3.58	0.58	3.66	2.70
2024	-0.22	3.17	-1.66	4.40	0.00	1.70	3.76	2.96	-0.14	3.29	1.59
2025	0.34	-0.56	-1.02	4.44	0.00	4.27	2.54	3.59	0.34	3.79	2.75
Compound growth rate (per cent) -											
2015-2020	-0.76	1.15	-1.53	5.03	0.00	3.05	3.64	3.52	1.33	3.28	2.10
2015-2025	-0.22	1.12	-1.27	4.74	0.00	3.20	2.97	3.47	0.78	3.44	2.21

All data are for the financial year ending in June of the year specified.

Table 5.4 Manufacturing Electricity Consumption - ENERGEX

	Food, Bev. & Tobacco	Textiles Clothing	Wood, Wood Prod's and Furniture	Paper, Paper Products Printing & Publishing	Chemical, Petroleum and Coal	Non-Metallic Mineral Products	Basic Metal Products	Fabri-cated Metal Products	Transport Equipment	Other Machinery and Equipment	Miscell -aneous Manufa-cturing
	ASIC 21	ASIC 23/24	ASIC 25	ASIC 26	ASIC 27	ASIC 28	ASIC 29	ASIC 31	ASIC 32	ASIC 33	ASIC 34
Unit	**					GWH	**				
BASE											
2010	580.43	65.96	135.75	245.97	681.31	419.20	625.50	187.59	90.03	173.25	72.21
2011	582.23	65.64	138.56	249.50	667.57	418.88	619.97	193.26	91.45	175.94	67.34
2012	576.86	61.49	133.48	239.30	651.95	403.51	584.82	186.09	88.39	168.78	65.37
2013	562.92	59.91	134.24	237.97	628.44	389.56	556.26	186.80	87.77	167.89	64.36
2014	544.90	58.07	134.30	236.29	604.98	373.76	526.69	186.43	87.65	166.75	61.79
2015	523.38	55.85	133.32	233.81	577.02	355.01	496.51	185.69	86.52	163.83	60.33
2016	511.31	54.46	134.24	234.88	559.44	343.15	474.77	186.36	86.36	162.97	59.62
2017	511.30	54.43	138.50	241.94	558.25	340.80	465.69	189.43	88.28	165.82	60.26
2018	506.25	53.89	140.76	246.30	550.69	334.55	454.96	191.16	88.73	166.19	60.17
2019	506.77	53.94	144.19	254.07	550.99	332.33	450.70	194.02	90.15	167.93	60.59
2020	511.63	54.42	148.72	264.40	556.19	332.79	452.62	198.10	91.63	170.19	61.32
2021	515.93	54.85	153.10	273.36	558.16	332.90	453.96	201.28	91.84	171.37	61.79
2022	515.66	54.96	155.73	279.90	557.06	330.55	451.53	202.47	92.17	171.78	61.94
2023	519.01	55.40	158.55	287.15	558.78	330.32	450.29	204.65	93.21	173.30	62.41
2024	517.50	55.25	160.33	291.99	554.29	326.21	445.07	206.10	93.31	173.35	62.32
2025	517.73	55.29	163.76	299.87	553.24	323.74	442.66	208.71	93.76	174.13	62.56
Percentage changes											
2011	0.31	-0.48	2.07	1.43	-2.02	-0.08	-0.88	3.02	1.58	1.55	-6.74
2012	-0.92	-6.33	-3.67	-4.09	-2.34	-3.67	-5.67	-3.71	-3.35	-4.07	-2.93
2013	-2.42	-2.58	0.56	-0.56	-3.61	-3.46	-4.88	0.38	-0.71	-0.53	-1.54
2014	-3.20	-3.06	0.05	-0.71	-3.73	-4.06	-5.32	-0.20	-0.13	-0.68	-4.00
2015	-3.95	-3.84	-0.73	-1.05	-4.62	-5.02	-5.73	-0.40	-1.29	-1.75	-2.36
2016	-2.31	-2.48	0.69	0.46	-3.05	-3.34	-4.38	0.36	-0.19	-0.53	-1.19
2017	0.00	-0.05	3.17	3.01	-0.21	-0.69	-1.91	1.65	2.22	1.75	1.08
2018	-0.99	-0.99	1.63	1.80	-1.35	-1.83	-2.30	0.91	0.51	0.22	-0.16
2019	0.10	0.08	2.44	3.16	0.05	-0.66	-0.94	1.49	1.60	1.05	0.71
2020	0.96	0.90	3.14	4.07	0.94	0.14	0.42	2.11	1.64	1.34	1.20
2021	0.84	0.78	2.95	3.39	0.35	0.03	0.30	1.60	0.23	0.69	0.77
2022	-0.05	0.20	1.72	2.39	-0.20	-0.71	-0.54	0.59	0.36	0.24	0.24
2023	0.65	0.81	1.81	2.59	0.31	-0.07	-0.27	1.08	1.13	0.88	0.76
2024	-0.29	-0.28	1.12	1.69	-0.80	-1.25	-1.16	0.71	0.11	0.03	-0.15
2025	0.04	0.09	2.14	2.70	-0.19	-0.76	-0.54	1.27	0.49	0.45	0.39
Compound growth rate (per cent) -											
2010-2015	-2.05	-3.27	-0.36	-1.01	-3.27	-3.27	-4.51	-0.20	-0.79	-1.11	-3.53
2015-2020	-0.45	-0.51	2.21	2.49	-0.73	-1.28	-1.83	1.30	1.15	0.76	0.33
2015-2025	-0.11	-0.10	2.08	2.52	-0.42	-0.92	-1.14	1.18	0.81	0.61	0.36

Table 5.4 Manufacturing Electricity Consumption – ENERGEX (continued)

	Food, Bev. & Tobacco	Textiles Clothing	Wood, Wood Prod's and Furniture	Paper, Paper Products Printing & Publishing	Chemical, Petroleum and Coal	Non-Metallic Mineral Products	Basic Metal Products	Fabri-cated Metal Products	Transport Equipment	Other Machinery and Equipment	Miscell -aneous Manufa-cturing
	ASIC 21	ASIC 23/24	ASIC 25	ASIC 26	ASIC 27	ASIC 28	ASIC 29	ASIC 31	ASIC 32	ASIC 33	ASIC 34
Unit	**					GWH	***				
HIGH - Levels											
2015	522.68	57.96	130.71	237.83	587.60	363.58	548.03	182.89	88.68	172.48	76.30
2016	519.84	57.76	134.02	244.38	580.94	358.74	533.94	186.26	90.32	175.44	77.46
2017	529.52	59.04	140.87	257.63	591.58	363.94	533.90	192.19	94.28	182.63	80.49
2018	534.27	59.80	145.87	268.36	595.65	365.07	531.79	196.88	96.80	187.34	82.63
2019	544.45	61.16	152.21	283.19	607.59	370.13	536.66	202.79	100.35	193.58	85.50
2020	560.37	63.16	160.07	301.78	626.22	378.90	549.57	210.27	104.24	200.91	89.02
2021	575.98	65.13	167.98	319.41	641.53	387.37	561.99	216.93	106.78	207.16	92.27
2022	586.28	66.73	173.99	334.37	652.96	392.72	569.54	221.45	109.40	212.46	95.06
2023	602.22	68.91	180.69	351.33	669.49	401.66	579.66	227.37	113.20	219.74	98.63
2024	612.51	70.37	186.30	365.76	678.48	405.73	584.48	232.54	115.89	225.23	101.37
2025	624.44	72.06	193.89	384.29	690.97	411.38	592.52	239.04	118.94	231.60	104.64
Percentage changes											
2015	-2.13	-1.64	1.21	1.36	-2.64	-2.94	-3.88	1.12	0.81	0.54	0.39
2016	-0.54	-0.34	2.53	2.76	-1.13	-1.33	-2.57	1.84	1.85	1.71	1.52
2017	1.86	2.21	5.11	5.42	1.83	1.45	-0.01	3.19	4.39	4.10	3.91
2018	0.90	1.29	3.55	4.17	0.69	0.31	-0.40	2.44	2.67	2.58	2.67
2019	1.91	2.29	4.34	5.53	2.00	1.39	0.92	3.00	3.67	3.33	3.47
2020	2.92	3.26	5.16	6.56	3.07	2.37	2.41	3.69	3.88	3.79	4.11
2021	2.79	3.13	4.94	5.84	2.45	2.24	2.26	3.17	2.44	3.11	3.65
2022	1.79	2.45	3.57	4.68	1.78	1.38	1.34	2.08	2.46	2.56	3.03
2023	2.72	3.28	3.85	5.07	2.53	2.27	1.78	2.68	3.47	3.43	3.76
2024	1.71	2.12	3.10	4.11	1.34	1.01	0.83	2.27	2.37	2.50	2.78
2025	1.95	2.39	4.07	5.07	1.84	1.39	1.38	2.80	2.64	2.83	3.22
Compound growth rate (per cent) -											
2015-2020	1.40	1.73	4.14	4.88	1.28	0.83	0.06	2.83	3.29	3.10	3.13
2015-2025	1.79	2.20	4.02	4.92	1.63	1.24	0.78	2.71	2.98	2.99	3.21

Table 5.4 Manufacturing Electricity Consumption – ENERGEX (continued)

	Food, Bev. & Tobacco	Textiles Clothing	Wood, Wood Prod's and Furniture	Paper, Paper Products Printing & Publishing	Chemical, Petroleum and Coal	Non-Metallic Mineral Products	Basic Metal Products	Fabri-cated Metal Products	Transport Equipment	Other Machinery and Equipment	Miscell-aneous Manufa-cturing
	ASIC 21	ASIC 23/24	ASIC 25	ASIC 26	ASIC 27	ASIC 28	ASIC 29	ASIC 31	ASIC 32	ASIC 33	ASIC 34
Unit	GWH										
LOW - Levels											
2015	511.73	51.29	137.83	224.22	559.19	350.35	477.08	190.44	85.15	167.09	55.55
2016	492.92	49.02	137.28	221.21	534.10	334.04	451.90	189.49	83.84	164.46	54.31
2017	485.85	48.01	140.13	223.78	524.83	327.10	438.96	190.94	84.51	165.54	54.30
2018	474.08	46.57	140.80	223.55	509.79	316.56	424.69	190.96	83.74	164.08	53.62
2019	467.89	45.68	142.68	226.50	502.55	310.18	416.80	192.15	83.93	164.03	53.42
2020	465.30	45.12	145.46	231.32	499.32	306.06	414.41	194.42	84.06	164.31	53.44
2021	462.17	44.52	148.05	234.77	493.19	301.67	411.51	195.76	83.00	163.51	53.23
2022	455.33	43.71	149.03	236.25	484.87	295.41	405.46	195.24	82.14	162.12	52.78
2023	450.99	43.11	149.92	237.76	478.23	290.58	400.04	195.49	81.77	161.50	52.52
2024	442.77	42.07	149.84	237.25	466.73	282.64	391.35	195.08	80.62	159.60	51.82
2025	436.39	41.23	151.36	239.25	458.63	276.45	385.42	195.80	79.84	158.48	51.43
Percentage changes											
2015	-5.36	-5.81	-1.86	-2.91	-6.12	-6.39	-6.67	-1.28	-2.69	-2.84	-3.44
2016	-3.68	-4.43	-0.40	-1.34	-4.49	-4.66	-5.28	-0.50	-1.53	-1.57	-2.23
2017	-1.43	-2.06	2.07	1.16	-1.74	-2.08	-2.86	0.77	0.80	0.65	-0.02
2018	-2.42	-3.01	0.48	-0.10	-2.86	-3.22	-3.25	0.01	-0.91	-0.88	-1.26
2019	-1.31	-1.92	1.34	1.32	-1.42	-2.02	-1.86	0.62	0.23	-0.03	-0.36
2020	-0.55	-1.21	1.95	2.13	-0.64	-1.33	-0.57	1.18	0.15	0.17	0.04
2021	-0.67	-1.33	1.78	1.49	-1.23	-1.43	-0.70	0.69	-1.26	-0.49	-0.40
2022	-1.48	-1.82	0.66	0.63	-1.69	-2.08	-1.47	-0.27	-1.03	-0.85	-0.85
2023	-0.95	-1.38	0.60	0.64	-1.37	-1.63	-1.34	0.13	-0.46	-0.38	-0.49
2024	-1.82	-2.40	-0.05	-0.22	-2.40	-2.73	-2.17	-0.21	-1.40	-1.17	-1.33
2025	-1.44	-1.99	1.02	0.85	-1.73	-2.19	-1.52	0.37	-0.97	-0.70	-0.75
Compound growth rate (per cent) -											
2015-2020	-1.88	-2.53	1.08	0.63	-2.24	-2.67	-2.78	0.41	-0.26	-0.33	-0.77
2015-2025	-1.58	-2.16	0.94	0.65	-1.96	-2.34	-2.11	0.28	-0.64	-0.53	-0.77

All data are for the financial year ending in June of the year specified.

TABLE 5.5 Small Scale PV - ENERGEX region

	Customer Numbers at 30th June	Capacity Total	Average unit size	Total Energy Produced	Export to Grid	In house usage	Capacity at System Peak
Unit	Number	** MW **	** KW **	***********	GWH	**********	** MW **
BASE							
2010	24252.00	41.50	1.71	29.41	9.02	20.39	13.70
2011	75766.00	165.70	2.19	142.42	44.21	98.21	54.68
2012	148311.00	373.00	2.51	461.43	170.21	291.23	123.09
2013	222211.00	558.10	2.51	1178.49	389.96	788.53	184.17
2014	260296.00	653.75	2.51	1530.15	526.83	1003.32	215.74
2015	296296.00	748.84	2.64	1804.90	639.47	1165.42	247.12
2016	343296.25	879.11	2.77	2152.61	784.20	1368.42	290.11
2017	386164.22	1000.92	2.84	2509.08	914.06	1595.02	330.30
2018	427439.13	1121.09	2.91	2883.16	1050.34	1832.83	369.96
2019	464120.81	1229.73	2.96	3247.36	1183.01	2064.35	405.81
2020	498753.78	1334.03	3.01	3603.51	1312.76	2290.75	440.23
2021	528223.50	1422.78	3.01	3916.29	1426.70	2489.58	469.52
2022	558289.69	1513.32	3.01	4240.03	1544.64	2695.39	499.40
2023	588885.88	1605.47	3.01	4579.24	1668.22	2911.02	529.80
2024	619923.44	1698.94	3.01	4920.36	1792.49	3127.87	560.65
2025	651414.63	1793.78	3.01	5276.42	1922.20	3354.22	591.95
Percentage changes							
2011	212.41	299.28	27.80	384.26	390.32	381.58	299.28
2012	95.75	125.11	15.00	223.99	284.95	196.55	125.11
2013	49.83	49.63	-0.14	155.40	129.11	170.76	49.63
2014	17.14	17.14	0.00	29.84	35.10	27.24	17.14
2015	13.83	14.55	5.18	17.96	21.38	16.16	14.55
2016	15.86	17.40	4.92	19.27	22.63	17.42	17.40
2017	12.49	13.86	2.53	16.56	16.56	16.56	13.86
2018	10.69	12.01	2.46	14.91	14.91	14.91	12.01
2019	8.58	9.69	1.72	12.63	12.63	12.63	9.69
2020	7.46	8.48	1.69	10.97	10.97	10.97	8.48
2021	5.91	6.65	0.00	8.68	8.68	8.68	6.65
2022	5.69	6.36	0.00	8.27	8.27	8.27	6.36
2023	5.48	6.09	0.00	8.00	8.00	8.00	6.09
2024	5.27	5.82	0.00	7.45	7.45	7.45	5.82
2025	5.08	5.58	0.00	7.24	7.24	7.24	5.58
Compound growth rate (per cent) -							
2010-2015	64.97	78.35	9.07	127.82	134.50	124.60	78.35
2015-2020	10.98	12.24	2.66	14.83	15.47	14.47	12.24
2015-2025	8.20	9.13	1.32	11.32	11.63	11.15	9.13

TABLE 5.5 Small Scale PV - ENERGEX region (continued)

	Customer Numbers at 30th June	Capacity Total	Average unit size	Total Energy Produced	Export to Grid	In house usage	Capacity at System Peak
Unit	Number	** MW **	** KW **	***********	GWH	**********	** MW **
HIGH - Levels							
2015	304296.00	769.98	2.64	1868.27	661.93	1206.34	254.09
2016	356818.94	915.55	2.77	2282.77	831.61	1451.16	302.13
2017	408151.63	1061.41	2.84	2724.48	992.53	1731.95	350.27
2018	458211.66	1207.17	2.91	3201.73	1166.39	2035.34	398.36
2019	498257.97	1325.76	2.96	3651.95	1330.41	2321.55	437.50
2020	537861.38	1445.03	3.01	4097.95	1492.88	2605.07	476.86
2021	572400.19	1549.05	3.01	4507.78	1642.18	2865.60	511.19
2022	607719.63	1655.41	3.01	4934.71	1797.71	3136.99	546.29
2023	643733.38	1763.87	3.01	5392.27	1964.40	3427.86	582.08
2024	680355.94	1874.16	3.01	5858.41	2134.22	3724.19	618.47
2025	717609.38	1986.35	3.01	6348.00	2312.58	4035.42	655.50
Percentage changes							
2015	16.90	17.78	5.18	21.22	24.75	19.38	17.78
2016	17.26	18.91	4.92	22.19	25.63	20.29	18.91
2017	14.39	15.93	2.53	19.35	19.35	19.35	15.93
2018	12.27	13.73	2.46	17.52	17.52	17.52	13.73
2019	8.74	9.82	1.72	14.06	14.06	14.06	9.82
2020	7.95	9.00	1.69	12.21	12.21	12.21	9.00
2021	6.42	7.20	0.00	10.00	10.00	10.00	7.20
2022	6.17	6.87	0.00	9.47	9.47	9.47	6.87
2023	5.93	6.55	0.00	9.27	9.27	9.27	6.55
2024	5.69	6.25	0.00	8.64	8.64	8.64	6.25
2025	5.48	5.99	0.00	8.36	8.36	8.36	5.99
Compound growth rate (per cent) -							
2015-2020	12.07	13.42	2.66	17.01	17.66	16.65	13.42
2015-2025	8.96	9.94	1.32	13.01	13.33	12.83	9.94
LOW - Levels							
2015	288296.00	727.71	2.64	1750.88	620.34	1130.54	240.15
2016	332424.72	850.02	2.77	2049.50	746.63	1302.87	280.51
2017	372273.91	963.25	2.84	2360.69	860.00	1500.69	317.87
2018	413071.22	1082.04	2.91	2695.10	981.82	1713.28	357.07
2019	443662.59	1172.63	2.96	2996.29	1091.55	1904.74	386.97
2020	469191.47	1249.51	3.01	3256.15	1186.22	2069.94	412.34
2021	492303.91	1319.12	3.01	3476.46	1266.48	2209.99	435.31
2022	515830.25	1389.97	3.01	3710.14	1351.60	2358.53	458.69
2023	539707.50	1461.88	3.01	3948.46	1438.42	2510.03	482.42
2024	563863.31	1534.62	3.01	4184.97	1524.58	2660.38	506.43
2025	588308.69	1608.24	3.01	4430.59	1614.06	2816.53	530.72
Percentage changes							
2015	10.76	11.31	5.18	14.86	18.19	13.11	11.31
2016	15.31	16.81	4.92	17.06	20.36	15.24	16.81
2017	11.99	13.32	2.53	15.18	15.18	15.18	13.32
2018	10.96	12.33	2.46	14.17	14.17	14.17	12.33
2019	7.41	8.37	1.72	11.18	11.18	11.18	8.37
2020	5.75	6.56	1.69	8.67	8.67	8.67	6.56
2021	4.93	5.57	0.00	6.77	6.77	6.77	5.57
2022	4.78	5.37	0.00	6.72	6.72	6.72	5.37
2023	4.63	5.17	0.00	6.42	6.42	6.42	5.17
2024	4.48	4.98	0.00	5.99	5.99	5.99	4.98
2025	4.34	4.80	0.00	5.87	5.87	5.87	4.80
Compound growth rate (per cent) -							
2015-2020	10.23	11.42	2.66	13.21	13.84	12.86	11.42
2015-2025	7.39	8.25	1.32	9.73	10.03	9.56	8.25

All data are for the financial year ending in June of the year specified.

6. ENERGEX distribution area maximum demand forecasts to 2025

6.1 Introduction

This section presents maximum demand estimates for ENERGEX distribution area to 2025. The methodology for forecasting ENERGEX distribution area maximum demands for summer and winter is outlined in Section 4. The summer MD forecasts extend to financial year 2024-25. The winter MD forecasts extend to winter 2024.

Carbon is removed from 2014-15 but re-introduced by 2020-21. The forecasts also incorporate the impact of small scale PV systems in the ENERGEX distribution region.

6.2 Forecasts of system maximum demand – summary of approach

Forecasts of maximum summer and winter demands (MDs) to 2025 are presented for three alternative temperature sets. These include temperatures of:

- Brisbane Airport daily mean winter temperatures of 10.0°C, 10.9°C and 12.3°C representing the 10th, 50th and 90th percentiles; and
- Brisbane (measured at Amberley) daily mean summer temperatures of 32.2°C, 30.2°C and 29.2°C representing the 10th, 50th and 90th percentiles for the summer season.

The alternative percentiles for system MD corresponds to the average of the daily minimum and maximum temperatures on the day of system MD.

For the summer MD, forecasts are also presented for 10th and 50th percentile summers. The 10th percentile corresponds to a continuing sequence of hot summers. The 50th percentile summer corresponds to a continuing sequence of average summers. Within each of these are the 10th, 50th and 90th percentile forecasts corresponding to individual days. Therefore, a total of six alternative summer MD forecasts are presented in this section for each economic scenario. It is the 50th summer that should be used for distribution planning purposes.

Demand figures in this section include embedded generators within the ENERGEX network, such as Rocky Point. They exclude smaller embedded generators within the ENERGEX network.

The projections also include the estimated impact of small scale PV systems on ENERGEX maximum demand forecasts. These forecasts have been revised since the 45¢ FIT was abolished for new customers. Small scale PV systems have increased rapidly within the ENERGEX distribution area over recent years. By 2014-15, PV systems reduce the summer maximum demand by some 250 MW. By 2019-20, under the base scenario, PV systems are estimated to reduce the summer demands by nearly 440 MW.

6.3 Forecasts of summer and winter maximum demands – 50th percentile

Forecasts of winter maximum demands for the base, high and low scenarios are presented in Table 6.1 for alternative probabilities of exceedence. Forecasts of summer maximum demands for the base, high and low scenarios for a 10th and 50th summer average temperature are presented in Tables 6.2 to 6.3 for alternative probabilities of exceedence. This commentary focuses on the 50th percentile. All commentary on the summer MD focuses on the 50th percentile summer only.

For these weather conditions:

- the winter peak rises to 4,181 MW in winter 2014, compared to the actual MD recorded in winter 2013 of 3,619 MW; and
- the summer peak is 4,310 MW in summer 2014-15, from 4,358 MW in 2013-14.

The key features of each scenario are described below.

The increase in reverse cycle air conditioner sales in ENERGEX distribution area over recent years may contribute to higher recorded winter MDs and sales over the next few years. The impact would depend upon the level of utilisation of this equipment. Three important factors which could increase the utilisation of this equipment are:

- the increase in smaller dwellings (floor area) such as townhouses and dual occupancy units which may be perceived to be more efficient to heat and cool using electrical equipment rather than gas equipment; and
- continuing warm to hot ambient summer temperatures.

An important feature of the MD projection for ENERGEX is the decline in the base load component of the MD. Base load has fallen from 2,450 in 2009-10 to 2,145 in 2014-15. This represents a fall of some 300 MW over the five year period.

The probability of a higher summer MD is covered, to some extent, in Table 6.2 which provides forecasts under a continuing sequence of 10 per cent PoE summers. Figures 6.1 and 6.2 show the projections for winter and summer maximum demands respectively for each scenario through to 2024 for the 50th percentile. The key features are as follows.

The base scenario

- Under the base scenario the winter MD rises to 4,181 MW by winter 2014 and to 4,996 MW by winter 2024.
- The summer MD under the base scenario is 4,310 MW by summer 2014-15 and around 5,289 MW by summer 2024-25.
- The summer MD under the base scenario rises by an average annual rate of 2.1 per cent per annum between 2014-15 and 2024-25, compared to average annual growth in total energy over the same period of 2.0 per cent per annum.

The high scenario

- Under the high scenario, the winter MD rises to 4,257 MW by winter 2014 and 6,272 MW by winter 2024.
- The summer MD under the high scenario rises to 4,384 MW by summer 2014-15 and 5,922 MW by summer 2024-25. The summer MD under the high scenario increases at an average annual rate of 3.1 per cent per annum, compared to average annual growth in energy of 3.0 per cent per annum.

The low scenario

- Under the low scenario, the winter MD rises to 4,017 MW by winter 2014 and 4,392 MW by winter 2024. The winter MD rises by an average annual rate of 0.7 per cent per annum between 2014 and 2024, compared to an average annual growth in total energy of 1.3 per cent per annum.
- The summer MD under the low scenario is 4,260 MW by summer 2014-15 and 4,968 MW by summer 2024-25. The summer MD grows by an average annual rate of 1.4 per cent per annum between 2014-15 and 2024-25 under the low scenario, compared to average annual growth in total energy over the same period of 1.3 per cent per annum.

Figure 6.1: ENERGEX winter maximum demand 50th percentile (10.9 degrees Celsius)

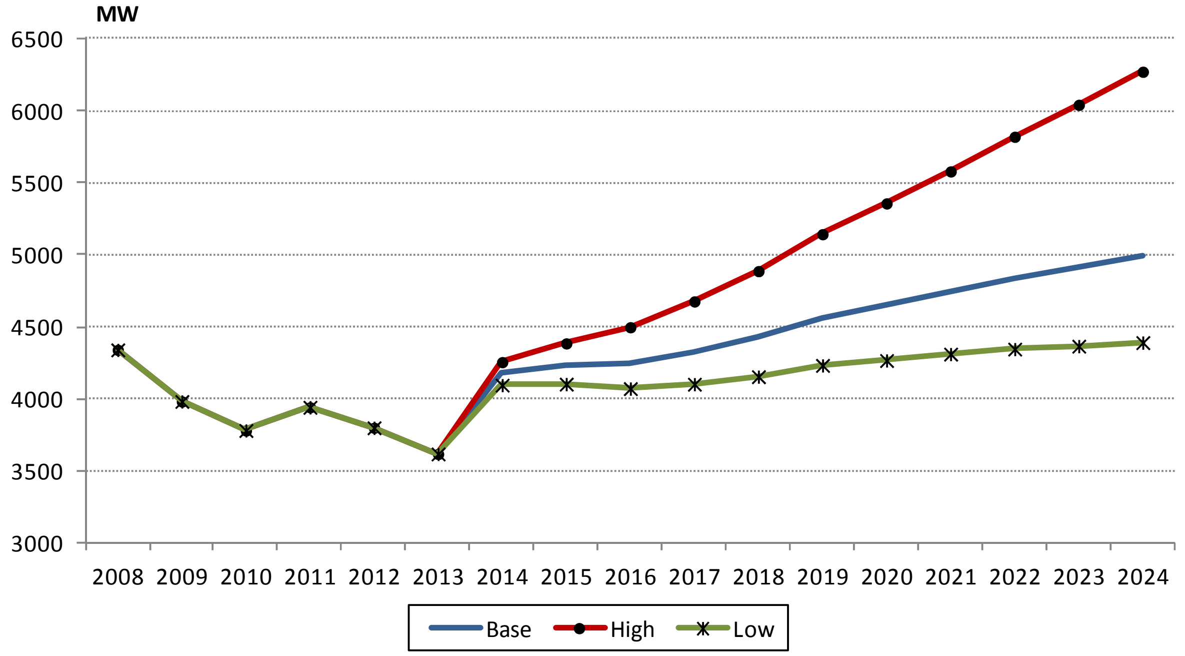


Figure 6.2: ENERGEX summer maximum demand 50th percentile summer, 50th percentile day

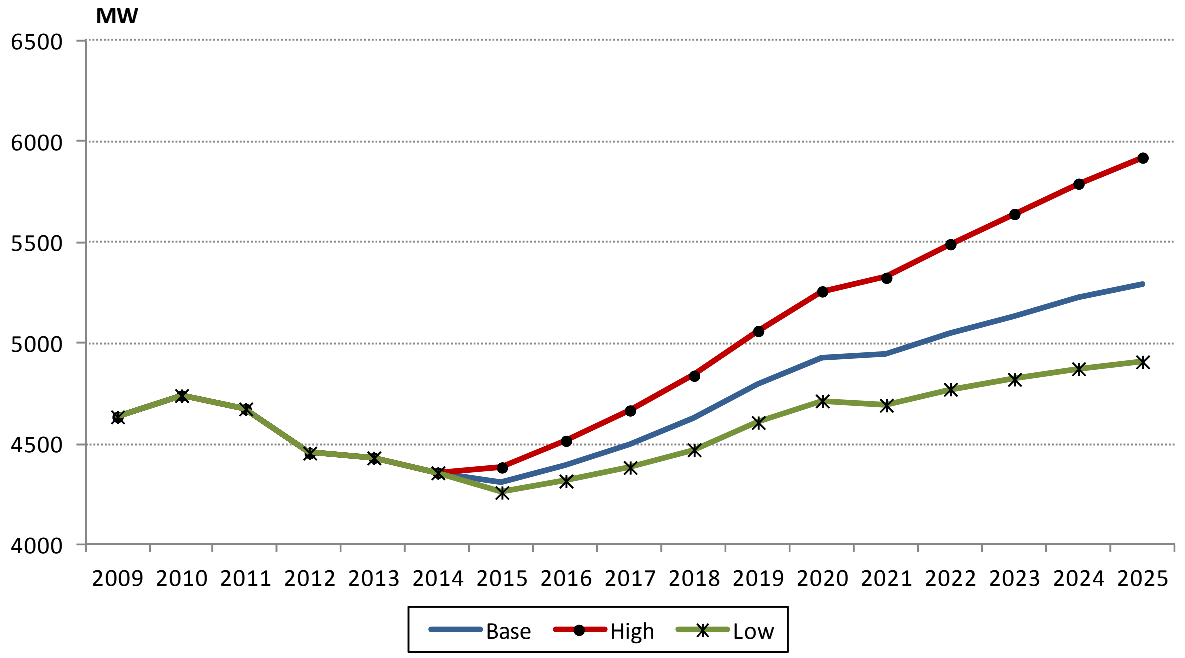


Figure 6.3: Small scale PV – ENERGEX – Estimated capacity at system peak

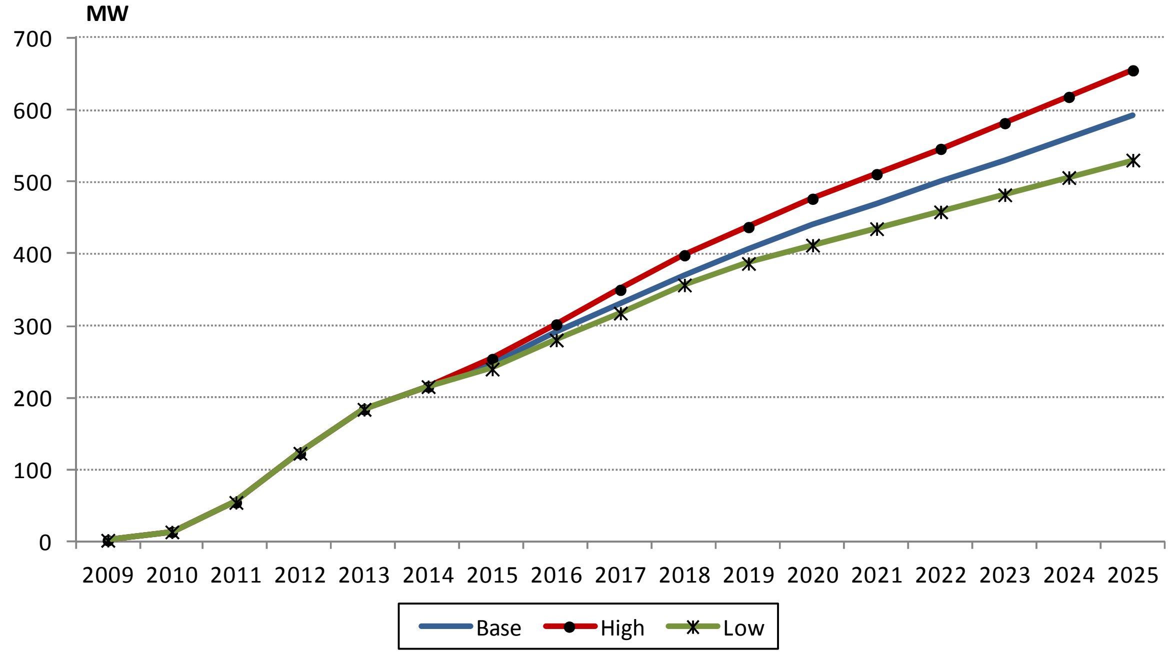


Table 6.1 MAXIMUM WINTER DEMANDS - ENERGEX

	10TH	50TH	90TH
Unit	***********	MW	***********
BASE			
2009	3983.46	3983.46	3983.46
2010	3782.12	3782.12	3782.12
2011	3942.94	3942.94	3942.94
2012	3800.87	3800.87	3800.87
2013	3619.02	3619.02	3619.02
2014	4299.74	4181.29	4006.13
2015	4347.85	4228.84	4052.81
2016	4366.72	4247.50	4071.12
2017	4449.41	4329.22	4151.34
2018	4552.93	4431.54	4251.78
2019	4685.43	4562.49	4380.34
2020	4774.10	4650.13	4466.37
2021	4870.25	4745.16	4559.65
2022	4966.09	4839.88	4652.64
2023	5042.85	4915.75	4727.12
2024	5123.66	4995.62	4805.52
Percentage changes			
2013	-4.78	-4.78	-4.78
2014	18.81	15.54	10.70
2015	1.12	1.14	1.17
2016	0.43	0.44	0.45
2017	1.89	1.92	1.97
2018	2.33	2.36	2.42
2019	2.91	2.96	3.02
2020	1.89	1.92	1.96
Compound growth rate (per cent) -			
2014-2020	1.76	1.79	1.83
2014-2024	1.77	1.80	1.84
HIGH - Levels			
2014	4406.78	4256.49	4123.46
2015	4538.29	4386.47	4251.05
2016	4651.72	4498.58	4361.11
2017	4833.27	4678.01	4537.25
2018	5046.05	4888.31	4743.69
2019	5305.50	5144.74	4995.42
2020	5521.60	5358.33	5205.09
2021	5746.39	5580.49	5423.18
2022	5989.51	5820.78	5659.06
2023	6213.78	6042.43	5876.65
2024	6446.20	6272.15	6102.15
Compound growth rate (per cent) -			
2014-2020	3.83	3.91	3.96
2014-2024	3.88	3.95	4.00
LOW - Levels			
2014	4234.33	4096.94	3948.42
2015	4241.38	4103.91	3955.26
2016	4209.78	4072.67	3924.59
2017	4240.91	4103.45	3954.80
2018	4293.72	4155.63	4006.03
2019	4372.80	4233.79	4082.76
2020	4407.44	4268.03	4116.37
2021	4452.19	4312.26	4159.79
2022	4487.38	4347.04	4193.93
2023	4507.96	4367.38	4213.89
2024	4532.94	4392.07	4238.14
Compound growth rate (per cent) -			
2014-2020	0.67	0.68	0.70
2014-2024	0.68	0.70	0.71

All data are for the Calendar year ending in December of the year specified.

TABLE 6.2 ENERGEX QLD Summer MDs - 10th Percentile Summer - 10th, 50th and 90th Percentile MDs

	Base Load	Less Small Scale PV	10th Percentile MD: Temperature Sensitive MW (eg AC)	10th Percentile MD: Total Region MD	50th Percentile MD: Temperature Sensitive MW (eg AC)	50th Percentile MD: Total Region MD	90th Percentile MD: Temperature Sensitive MW (eg AC)	90th Percentile MD: Total Region MD
Unit	MWs							
BASE								
2010	2445.43	13.70	2295.37	4740.80	2295.37	4740.80	2295.37	4740.80
2011	2374.11	54.68	2300.33	4674.44	2300.33	4674.44	2300.33	4674.44
2012	2281.98	123.09	2173.34	4455.32	2173.34	4455.32	2173.34	4455.32
2013	2226.13	184.17	2205.57	4431.70	2205.57	4431.70	2205.57	4431.70
2014	2182.18	215.74	2175.51	4357.69	2175.51	4357.69	2175.51	4357.69
2015	2145.22	247.12	2949.15	4746.84	2643.55	4421.16	2534.41	4291.93
2016	2159.46	290.11	3113.39	4885.64	2791.25	4544.08	2676.20	4409.61
2017	2165.03	330.30	3254.17	5028.66	2917.85	4680.29	2797.74	4548.12
2018	2189.35	369.96	3414.94	5198.58	3062.43	4838.92	2936.53	4705.87
2019	2219.58	405.81	3571.05	5402.00	3202.81	5037.20	3071.30	4909.13
2020	2257.94	440.23	3722.27	5580.44	3338.80	5205.07	3201.85	5076.21
2021	2283.41	469.52	3846.92	5644.33	3450.90	5245.02	3309.46	5100.29
2022	2310.84	499.40	3979.81	5791.90	3570.41	5382.62	3424.19	5236.53
2023	2338.01	529.80	4111.43	5917.99	3688.77	5495.00	3537.82	5343.72
2024	2359.64	560.65	4231.40	6039.97	3796.65	5607.14	3641.39	5453.79
2025	2382.29	591.95	4350.93	6144.89	3904.15	5698.83	3744.58	5539.98
Percentage changes								
2011	-2.92	299.28	0.22	-1.40	0.22	-1.40	0.22	-1.40
2012	-3.88	125.11	-5.52	-4.69	-5.52	-4.69	-5.52	-4.69
2013	-2.45	49.63	1.48	-0.53	1.48	-0.53	1.48	-0.53
2014	-1.97	17.14	-1.36	-1.67	-1.36	-1.67	-1.36	-1.67
2015	-1.69	14.55	35.56	8.93	21.51	1.46	16.50	-1.51
2016	0.66	17.40	5.57	2.92	5.59	2.78	5.59	2.74
2017	0.26	13.86	4.52	2.93	4.54	3.00	4.54	3.14
2018	1.12	12.01	4.94	3.38	4.95	3.39	4.96	3.47
2019	1.38	9.69	4.57	3.91	4.58	4.10	4.59	4.32
2020	1.73	8.48	4.23	3.30	4.25	3.33	4.25	3.40
2021	1.13	6.65	3.35	1.14	3.36	0.77	3.36	0.47
2022	1.20	6.36	3.45	2.61	3.46	2.62	3.47	2.67
2023	1.18	6.09	3.31	2.18	3.32	2.09	3.32	2.05
2024	0.93	5.82	2.92	2.06	2.92	2.04	2.93	2.06
2025	0.96	5.58	2.82	1.74	2.83	1.64	2.83	1.58
Compound growth rate (per cent) -								
2010-2015	-2.59	78.35	5.14	0.03	2.86	-1.39	2.00	-1.97
2015-2020	1.03	12.24	4.77	3.29	4.78	3.32	4.79	3.41
2015-2025	1.05	9.13	3.97	2.62	3.98	2.57	3.98	2.59

TABLE 6.2 ENERGEX QLD Summer MDs - 10th Percentile Summer - 10th, 50th and 90th Percentile MDs (continued)

	Base Load	Less Small Scale PV	10th Percentile MD: Temperature Sensitive MW (eg AC)	10th Percentile MD: Total Region MD	50th Percentile MD: Temperature Sensitive MW (eg AC)	50th Percentile MD: Total Region MD	90th Percentile MD: Temperature Sensitive MW (eg AC)	90th Percentile MD: Total Region MD
Unit	********************************		MWs	**************************************				
HIGH - Levels								
2015	2175.22	254.09	3010.62	4831.33	2699.58	4500.22	2588.50	4369.05
2016	2213.27	302.13	3207.37	5021.54	2876.52	4671.30	2758.36	4533.74
2017	2245.80	350.27	3383.93	5219.40	3035.30	4858.75	2910.79	4722.23
2018	2297.31	398.36	3579.84	5443.16	3211.48	5067.67	3079.92	4928.99
2019	2356.87	437.50	3771.51	5708.65	3383.84	5324.54	3245.38	5189.64
2020	2428.37	476.86	3961.10	5953.72	3554.34	5555.18	3409.06	5418.13
2021	2487.03	511.19	4123.23	6081.72	3700.14	5655.15	3549.03	5500.57
2022	2547.24	546.29	4291.89	6293.35	3851.81	5853.38	3694.64	5696.31
2023	2611.47	582.08	4464.38	6491.93	4006.92	6034.11	3843.55	5870.37
2024	2669.93	618.47	4624.17	6685.31	4150.62	6213.70	3981.50	6046.51
2025	2729.78	655.50	4782.91	6860.58	4293.38	6371.71	4118.54	6197.56
Percentage changes								
2015	-0.32	17.78	38.39	10.87	24.09	3.27	18.98	0.26
2016	1.75	18.91	6.54	3.94	6.55	3.80	6.56	3.77
2017	1.47	15.93	5.50	3.94	5.52	4.01	5.53	4.16
2018	2.29	13.73	5.79	4.29	5.80	4.30	5.81	4.38
2019	2.59	9.82	5.35	4.88	5.37	5.07	5.37	5.29
2020	3.03	9.00	5.03	4.29	5.04	4.33	5.04	4.40
2021	2.42	7.20	4.09	2.15	4.10	1.80	4.11	1.52
2022	2.42	6.87	4.09	3.48	4.10	3.51	4.10	3.56
2023	2.52	6.55	4.02	3.16	4.03	3.09	4.03	3.06
2024	2.24	6.25	3.58	2.98	3.59	2.98	3.59	3.00
2025	2.24	5.99	3.43	2.62	3.44	2.54	3.44	2.50
Compound growth rate (per cent) -								
2015-2020	2.23	13.42	5.64	4.27	5.66	4.30	5.66	4.40
2015-2025	2.30	9.94	4.74	3.57	4.75	3.54	4.75	3.56
LOW - Levels								
2015	2125.22	240.15	2891.19	4675.86	2590.93	4355.51	2483.69	4228.19
2016	2127.33	280.51	3026.88	4776.54	2712.95	4443.18	2600.83	4311.63
2017	2117.85	317.87	3137.19	4876.87	2812.15	4539.77	2696.06	4411.62
2018	2127.19	357.07	3267.68	5002.02	2929.50	4656.68	2808.72	4528.75
2019	2142.97	386.97	3394.12	5167.22	3043.20	4819.72	2917.87	4697.81
2020	2166.48	412.34	3514.13	5308.64	3151.13	4953.70	3021.48	4832.13
2021	2176.74	435.31	3608.64	5333.81	3236.12	4958.03	3103.07	4821.73
2022	2189.94	458.69	3713.16	5445.10	3330.11	5062.18	3193.31	4925.51
2023	2200.30	482.42	3812.46	5528.75	3419.41	5135.38	3279.03	4994.69
2024	2206.34	506.43	3901.83	5611.29	3499.78	5211.14	3356.19	5069.46
2025	2213.66	530.72	3991.44	5678.08	3580.36	5267.73	3433.55	5121.66
Percentage changes								
2015	-2.61	11.31	32.90	7.30	19.10	-0.05	14.17	-2.97
2016	0.10	16.81	4.69	2.15	4.71	2.01	4.72	1.97
2017	-0.45	13.32	3.64	2.10	3.66	2.17	3.66	2.32
2018	0.44	12.33	4.16	2.57	4.17	2.58	4.18	2.66
2019	0.74	8.37	3.87	3.30	3.88	3.50	3.89	3.73
2020	1.10	6.56	3.54	2.74	3.55	2.78	3.55	2.86
2021	0.47	5.57	2.69	0.47	2.70	0.09	2.70	-0.22
2022	0.61	5.37	2.90	2.09	2.90	2.10	2.91	2.15
2023	0.47	5.17	2.67	1.54	2.68	1.45	2.68	1.40
2024	0.27	4.98	2.34	1.49	2.35	1.48	2.35	1.50
2025	0.33	4.80	2.30	1.19	2.30	1.09	2.30	1.03
Compound growth rate (per cent) -								
2015-2020	0.39	11.42	3.98	2.57	3.99	2.61	4.00	2.71
2015-2025	0.41	8.25	3.28	1.96	3.29	1.92	3.29	1.94

All data are for the financial year ending in June of the year specified.

TABLE 6.3 ENERGEX QLD Summer MDs - 50th Percentile Summer - 10th, 50th and 90th Percentile MDs

	Base Load	Less Small Scale PV	10th Percentile MD: Temperature Sensitive MW (eg AC)	10th Percentile MD: Total Region MD	50th Percentile MD: Temperature Sensitive MW (eg AC)	50th Percentile MD: Total Region MD	90th Percentile MD: Temperature Sensitive MW (eg AC)	90th Percentile MD: Total Region MD
Unit	********************************		MWs	********************************				
BASE								
2010	2445.43	13.70	2295.37	4740.80	2295.37	4740.80	2295.37	4740.80
2011	2374.11	54.68	2300.33	4674.44	2300.33	4674.44	2300.33	4674.44
2012	2281.98	123.09	2173.34	4455.32	2173.34	4455.32	2173.34	4455.32
2013	2226.13	184.17	2205.57	4431.70	2205.57	4431.70	2205.57	4431.70
2014	2182.18	215.74	2175.51	4357.69	2175.51	4357.69	2175.51	4357.69
2015	2145.22	247.12	2853.63	4651.33	2531.89	4309.50	2188.69	3946.22
2016	2159.46	290.11	2980.48	4752.72	2644.84	4397.67	2286.83	4020.23
2017	2165.03	330.30	3085.39	4859.87	2738.27	4500.70	2368.00	4118.39
2018	2189.35	369.96	3211.17	4994.81	2850.27	4626.76	2465.32	4234.66
2019	2219.58	405.81	3333.47	5164.43	2959.19	4793.58	2559.95	4397.78
2020	2257.94	440.23	3452.04	5310.22	3064.78	4931.04	2651.69	4526.05
2021	2283.41	469.52	3545.47	5342.89	3147.97	4942.10	2723.98	4514.80
2022	2310.84	499.40	3648.04	5460.13	3239.31	5051.53	2803.34	4615.68
2023	2338.01	529.80	3750.33	5556.89	3330.40	5136.63	2882.48	4688.38
2024	2359.64	560.65	3842.07	5650.64	3412.10	5222.58	2953.46	4765.86
2025	2382.29	591.95	3934.29	5728.25	3494.22	5288.90	3024.82	4820.22
Percentage changes								
2011	-2.92	299.28	0.22	-1.40	0.22	-1.40	0.22	-1.40
2012	-3.88	125.11	-5.52	-4.69	-5.52	-4.69	-5.52	-4.69
2013	-2.45	49.63	1.48	-0.53	1.48	-0.53	1.48	-0.53
2014	-1.97	17.14	-1.36	-1.67	-1.36	-1.67	-1.36	-1.67
2015	-1.69	14.55	31.17	6.74	16.38	-1.11	0.61	-9.44
2016	0.66	17.40	4.44	2.18	4.46	2.05	4.48	1.88
2017	0.26	13.86	3.52	2.25	3.53	2.34	3.55	2.44
2018	1.12	12.01	4.08	2.78	4.09	2.80	4.11	2.82
2019	1.38	9.69	3.81	3.40	3.82	3.61	3.84	3.85
2020	1.73	8.48	3.56	2.82	3.57	2.87	3.58	2.92
2021	1.13	6.65	2.71	0.62	2.71	0.22	2.73	-0.25
2022	1.20	6.36	2.89	2.19	2.90	2.21	2.91	2.23
2023	1.18	6.09	2.80	1.77	2.81	1.68	2.82	1.58
2024	0.93	5.82	2.45	1.69	2.45	1.67	2.46	1.65
2025	0.96	5.58	2.40	1.37	2.41	1.27	2.42	1.14
Compound growth rate (per cent) -								
2010-2015	-2.59	78.35	4.45	-0.38	1.98	-1.89	-0.95	-3.60
2015-2020	1.03	12.24	3.88	2.69	3.89	2.73	3.91	2.78
2015-2025	1.05	9.13	3.26	2.10	3.27	2.07	3.29	2.02

TABLE 6.3 ENERGEX QLD Summer MDs - 50th Percentile Summer - 10th, 50th and 90th Percentile MDs (continued)

	Base Load	Less Small Scale PV	10th Percentile MD: Temperature Sensitive MW (eg AC)	10th Percentile MD: Total Region MD	50th Percentile MD: Temperature Sensitive MW (eg AC)	50th Percentile MD: Total Region MD	90th Percentile MD: Temperature Sensitive MW (eg AC)	90th Percentile MD: Total Region MD
Unit	MWs							
HIGH - Levels								
2015	2175.22	254.09	2910.57	4731.29	2583.41	4384.05	2234.44	4014.99
2016	2213.27	302.13	3065.82	4880.00	2721.66	4516.44	2354.56	4129.95
2017	2245.80	350.27	3202.51	5037.98	2843.38	4666.84	2460.32	4271.76
2018	2297.31	398.36	3359.55	5222.87	2983.23	4839.42	2581.82	4430.89
2019	2356.87	437.50	3513.64	5450.79	3120.45	5061.15	2701.05	4645.30
2020	2428.37	476.86	3666.89	5659.51	3256.92	5257.77	2819.62	4828.69
2021	2487.03	511.19	3794.23	5752.71	3370.32	5325.33	2918.15	4869.68
2022	2547.24	546.29	3929.12	5930.58	3490.44	5492.00	3022.51	5024.18
2023	2611.47	582.08	4068.85	6096.41	3614.87	5642.06	3130.63	5157.45
2024	2669.93	618.47	4197.13	6258.26	3729.10	5792.17	3229.87	5294.88
2025	2729.78	655.50	4325.36	6403.03	3843.30	5921.64	3329.10	5408.11
Percentage changes								
2015	-0.32	17.78	33.79	8.57	18.75	0.60	2.71	-7.86
2016	1.75	18.91	5.33	3.14	5.35	3.02	5.38	2.86
2017	1.47	15.93	4.46	3.24	4.47	3.33	4.49	3.43
2018	2.29	13.73	4.90	3.67	4.92	3.70	4.94	3.73
2019	2.59	9.82	4.59	4.36	4.60	4.58	4.62	4.84
2020	3.03	9.00	4.36	3.83	4.37	3.88	4.39	3.95
2021	2.42	7.20	3.47	1.65	3.48	1.29	3.49	0.85
2022	2.42	6.87	3.56	3.09	3.56	3.13	3.58	3.17
2023	2.52	6.55	3.56	2.80	3.57	2.73	3.58	2.65
2024	2.24	6.25	3.15	2.65	3.16	2.66	3.17	2.66
2025	2.24	5.99	3.06	2.31	3.06	2.24	3.07	2.14
Compound growth rate (per cent) -								
2015-2020	2.23	13.42	4.73	3.65	4.74	3.70	4.76	3.76
2015-2025	2.30	9.94	4.04	3.07	4.05	3.05	4.07	3.02
LOW - Levels								
2015	2125.22	240.15	2813.22	4597.89	2495.35	4259.93	2156.29	3900.79
2016	2127.33	280.51	2915.54	4665.20	2586.47	4316.70	2235.46	3946.25
2017	2117.85	317.87	2993.92	4733.60	2656.26	4383.88	2296.10	4011.66
2018	2127.19	357.07	3093.23	4827.58	2744.70	4471.89	2372.94	4092.97
2019	2142.97	386.97	3189.55	4962.65	2830.48	4607.00	2447.46	4227.40
2020	2166.48	412.34	3280.51	5075.02	2911.48	4714.06	2517.84	4328.49
2021	2176.74	435.31	3347.27	5072.43	2970.92	4692.84	2569.49	4288.15
2022	2189.94	458.69	3424.80	5156.73	3039.97	4772.04	2629.48	4361.68
2023	2200.30	482.42	3498.05	5214.34	3105.20	4821.17	2686.16	4401.81
2024	2206.34	506.43	3562.37	5271.82	3162.47	4873.84	2735.92	4449.19
2025	2213.66	530.72	3627.73	5314.36	3220.68	4908.05	2786.49	4474.60
Percentage changes								
2015	-2.61	11.31	29.31	5.51	14.70	-2.24	-0.88	-10.48
2016	0.10	16.81	3.64	1.46	3.65	1.33	3.67	1.17
2017	-0.45	13.32	2.69	1.47	2.70	1.56	2.71	1.66
2018	0.44	12.33	3.32	1.99	3.33	2.01	3.35	2.03
2019	0.74	8.37	3.11	2.80	3.13	3.02	3.14	3.28
2020	1.10	6.56	2.85	2.26	2.86	2.32	2.88	2.39
2021	0.47	5.57	2.03	-0.05	2.04	-0.45	2.05	-0.93
2022	0.61	5.37	2.32	1.66	2.32	1.69	2.33	1.71
2023	0.47	5.17	2.14	1.12	2.15	1.03	2.16	0.92
2024	0.27	4.98	1.84	1.10	1.84	1.09	1.85	1.08
2025	0.33	4.80	1.83	0.81	1.84	0.70	1.85	0.57
Compound growth rate (per cent) -								
2015-2020	0.39	11.42	3.12	1.99	3.13	2.05	3.15	2.10
2015-2025	0.41	8.25	2.58	1.46	2.58	1.43	2.60	1.38

All data are for the financial year ending in June of the year specified.

7. An assessment of the accuracy of the current summer MD forecast methodology: a backcasting exercise

7.1 Introduction

Partly for checking and quality control reasons, NIEIR undertook a detailed backcasting exercise for ENERGEX.

NIEIR assembled half hourly data for the ENERGEX system from 1997 to 2014. The annual summer peaks were identified from 1997 to 2014.

Given the diversity in the actual ENERGEX summer peaks in terms of a number of factors, such as their timing and time of season, a number of adjustments were made to the **actual** ENERGEX MD to derive a **corrected ENERGEX summer MD**. In most cases these are few and not significant.

Under the current forecast methodology, the ENERGEX summer MD forecast is a forecast for 2:30 p.m. in mid-February.

7.2 Actual and corrected summer MDs

The corrected ENERGEX summer MDs were calculated after allowing for the following adjustments:

(i) **time of season correction:** that is, where the MD occurred during or close to the school holiday period, so that the actual demand is understated (e.g. due to schools being closed, etc.);

(ii) **time of MD correction:** this typically covers the case where a cool change in mid-afternoon leads to a sharp fall in load. The actual peak in this case typically falls between 10:00 a.m. and 4:30 p.m. and not at the 2:30 p.m. time interval which the forecasts are designed to predict; and

(iii) **temperature sensitive equipment sales (e.g. air conditioners):** this reflects the mid-February basis of the forecast. An early December summer MD implies not all of the temperature sensitive equipment is installed at the summer MD.

The following analysis does not correct for the temperature on the previous day before the ENERGEX summer MD.

The correction for the 2007-08 summer is quite significant. It reflects the fact that the ENERGEX summer MD occurred on a Saturday in February in the coldest summer since 1940 at least. The peak for 2011-12 was early January, when a significant number of businesses were closed and employees on leave.

Additional adjustments could also possibly be made for day of week effects on the recorded MDs. Actual MDs for 2008-09, 2009-10 and 2010-11 have all occurred on a Monday. The peak for 2013-14 was on 22 January 2014.

Table 7.1	Actual, corrected ENERGEX summer MDs and temperatures and percentiles of MDs and overall summers				

	Actual MD	Corrected MD	Average temperature	Percentile MD	Overall summer temperature	Percentile summer
1996-97	2407	2417	28.4	90th	24.5	85th
1997-98	2596	2656	29.3	75th	26.2	8th
1998-99	2754	2754	29.2	73rd	24.6	80th
1999-00	2939	3037	31.9	20th	23.2	99th
2000-01	2970	2990	29.9	55th	25.0	50th
2001-02	3114	3124	30.4	45th	25.9	20th
2002-03	3376	3438	31.8	20th	24.8	65th
2003-04	3847	3847	30.6	40th	26.1	10th
2004-05	4024	4024	29.3	75th	25.1	45th
2005-06	4149	4149	28.6	90th	26.7	2nd
2006-07	4302	4302	28.7	87th	24.5	85th
2007-08	4087	4587	30.4	55th	22.1	100th
2008-09	4635	4635	27.5	100th	25.1	45th
2009-10	4741	4741	29.3	75th	25.6	30th
2010-11	4674	4674	29.1	78th	25.1	40th
2011-12	4451	5051	30.7	33rd	23.8	98th
2012-13	4432	4432	29.6	65th	25.2	40th
2013-14	4358	4358	30.2	45th	24.8	65th

The current forecast methodology

Under the current forecast methodology, NIEIR prepares nine forecasts of the summer MD. These are 10th, 50th and 90th percentile MD day forecasts within 10th, 50th and 90th percentile overall summers.

NIEIR has demonstrated empirically, using both individual and pooled summers, that the level of utilisation of temperature sensitive equipment (such as air conditioners) varies with how hot the actual summer is.

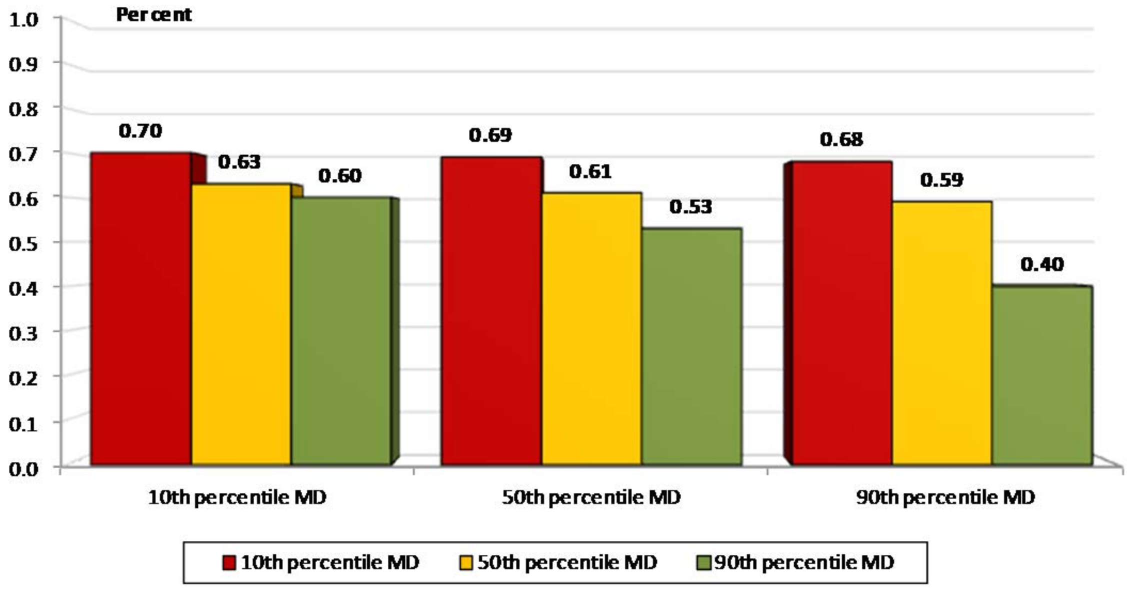
NIEIR's current forecast methodology, therefore, includes a different rate of utilisation for temperature sensitive load across the 10th, 50th and 90th summers for different 10th, 50th and 90th summer MDs. Figure 7.1 illustrates the alternative utilisation rates across the 10th, 50th and 90th summers for alternative percentile summer MD forecasts. As the air conditioning stock has grown over time, these utilisation rates have been successively revised downwards. The 10th percentile utilisation rates were revised downwards given recorded actuals.

A number of points can be made in respect to Figure 7.1.

(i) The utilisation band at the 10th is much narrower than the band at the 50th and 90th percentile MDs.

(ii) There is uncertainty surrounding the width of the 10th band given we have relatively little historical data to support our empirical analysis.

Figure 7.1: Temperature sensitive load utilisation rates by type of summer



7.3 Corrected ENERGEX summer actuals versus forecast bands

Given estimates of the stock of temperature sensitive load and base load, a back-casting exercise can be performed using these bands to assess how accurate the current forecasting methodology actually is.

Figures 7.2, 7.3 and 7.4 plot the corrected ENERGEX summer MDs against the three temperature bands. The MD's, shaded red in each graph, are of key interest.

Figure 7.2 shows the 10th percentile band forecasts and corrected ENERGEX summer MDs.

There have been two close to 10th percentile summer MD's since 1997. These include 1999-00 (20th percentile), 2003-04 (40th percentile). As indicated in Figure 7.2, both peaks fit reasonably well to the 10th bands, although slightly below.

Figure 7.2: Actual corrected ENERGEX summer MDs and the 10th percentile band

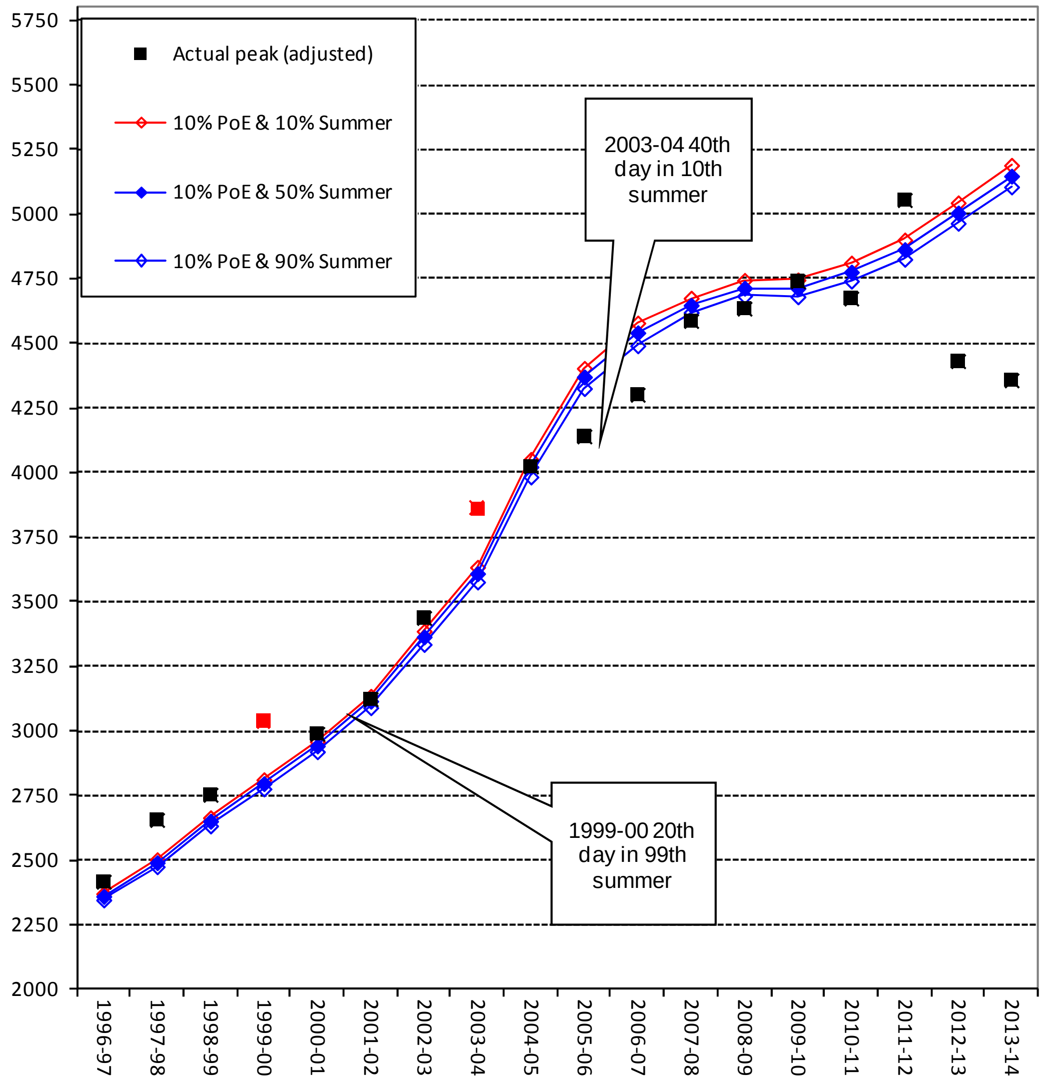


Figure 7.3 shows the 50th percentile band and the corrected ENERGEX summer MDs. From this figure the following MDs fall around the band correctly, although the 2004-05 forecast is a little low:

- 2000-01 (a 55th day in 50th overall summer);
- 2001-02 (a 45th in an extreme summer 20th summer);
- 2002-03 (a 20th in a 65th summer);
- 2004-05 (a 75th in a 45th percentile summer); and
- 2011-12 (a 40th in a 98th percentile summer).

Figure 7.3: Actual corrected ENERGEX summer MDs and the 50th percentile band

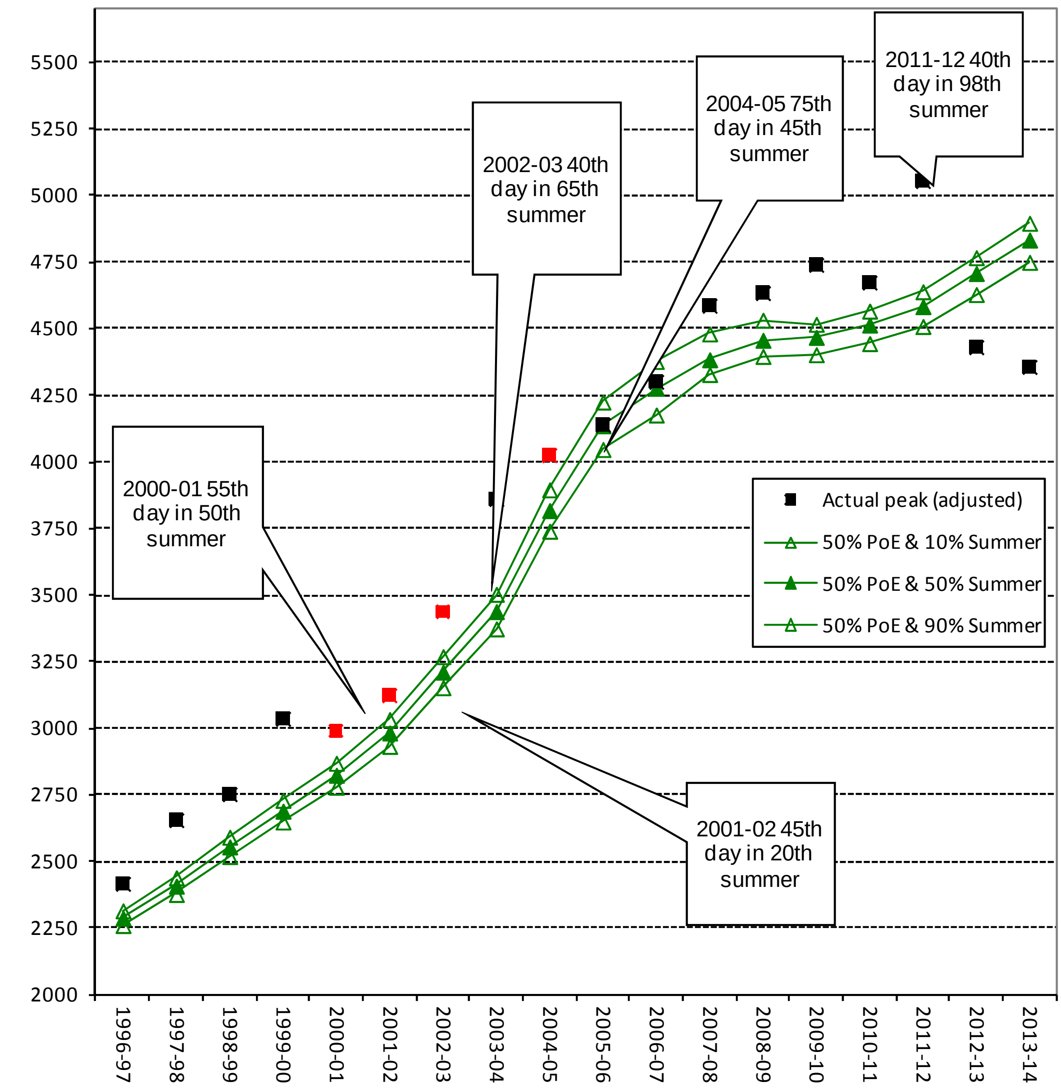
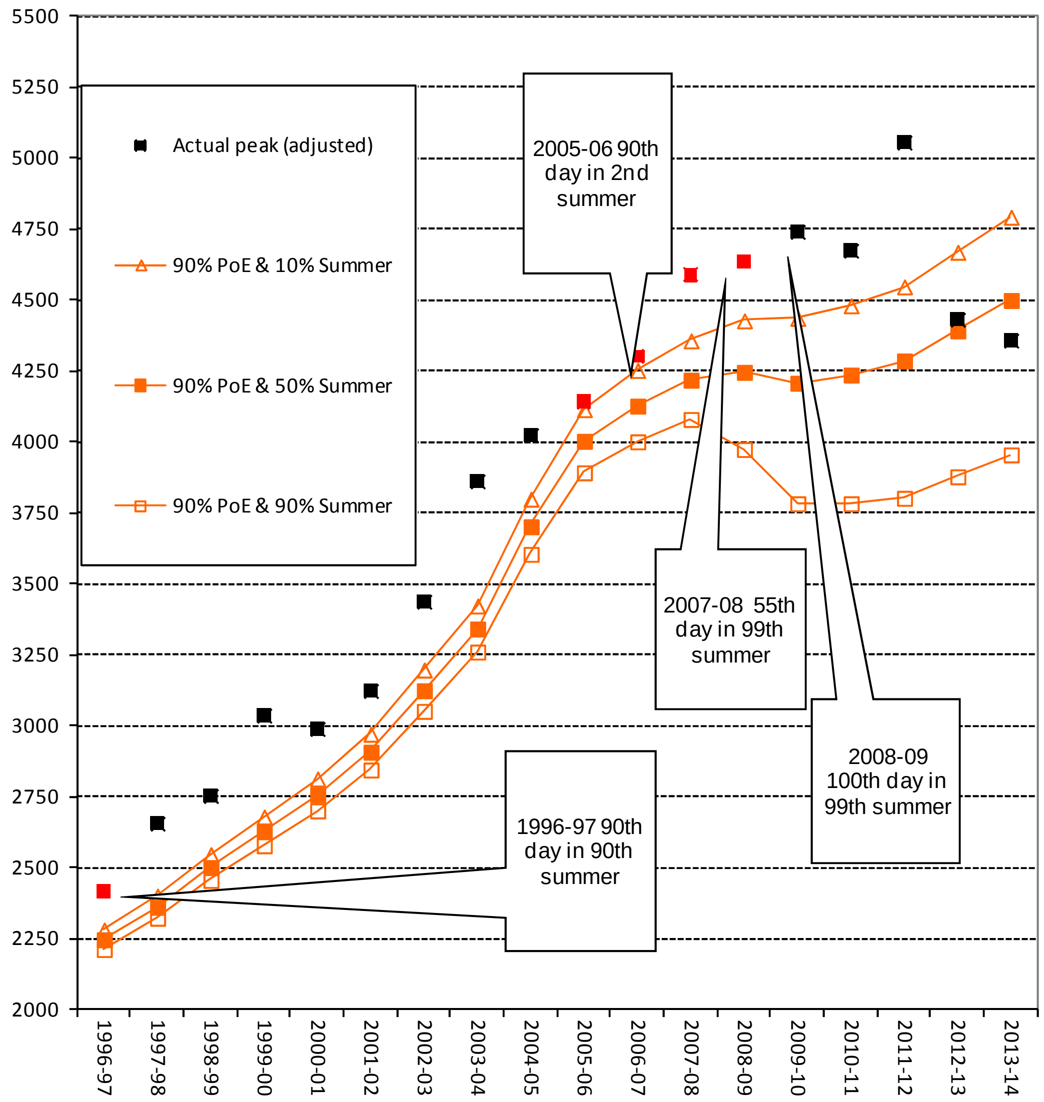


Figure 7.4 shows the 90th percentile bands and the corrected ENERGEX summer MDs. There were close to 90th percentile MDs in 1996-97 (90th), 2005-06 (90th) and 2006-07 (87th).

All corrected actuals fit correctly within and around the forecast bans for the 90th percentile.

The corrected 2007-08 ENERGEX summer MD falls within the 90th percentile band. The correction may be too conservative and is subject to uncertainties. The 2008-09 and 2009-10 summer MDs also lie at the lower end of the 90th percentile band.

Figure 7.4: Actual corrected ENERGEX summer MDs and the 90th percentile band



Appendix A: NIEIR's energy modelling systems

- NIEIR's energy modelling capability has been gradually developed over the last fifteen years. The energy demand and production model is an integral part of NIEIR's Institute Multipurpose model (IMP model).
- The energy modelling systems developed by NIEIR have been applied in analysing numerous energy related issues including, over recent years:
  - the impact of removal of cross-subsidies in electricity prices;
  - forecasts of electricity demand and load growth;
  - projections of greenhouse gas emissions;
  - evaluating alternative power station options for Victoria, Queensland, Western Australia and Tasmania; and
  - assessing the impact of increased penetration of energy efficient technologies and renewable energies on energy demand and supply and greenhouse gas emissions.
- NIEIR's energy demand and supply model offers flexibility in the mode of model use. It is directly linked to macroeconomic models of the national and State economies so that feedback effects between the energy sector (prices, investment) and the overall economy are effectively identified.

The alternative modes of model use include:

- energy demand and supply forecasting at the State industry level (the model is now being extended to sub-State/regional levels);
- dynamic policy analysis (e.g. assessing the impact of removal of cross subsidies in tariffs); and
- end-use technology forecasts which disaggregate energy demand by service and efficiency.

Figure A.1 shows the overall integrated structure of NIEIR's energy modelling system. The system comprises of:

- the national macroeconomic and industry activity model;
- a State economic and industry activity model;
- an energy forecasting model (EFM);
- an energy technology model (ETM);
- an energy environmental impact model (ENVI); and
- energy production and pricing model.

The national and State economic models provide forecasts of industry output by sector, capital stocks, dwellings formation numbers and population by State and Territory.

Figure A.1: NIEIR's integrated energy modelling systems

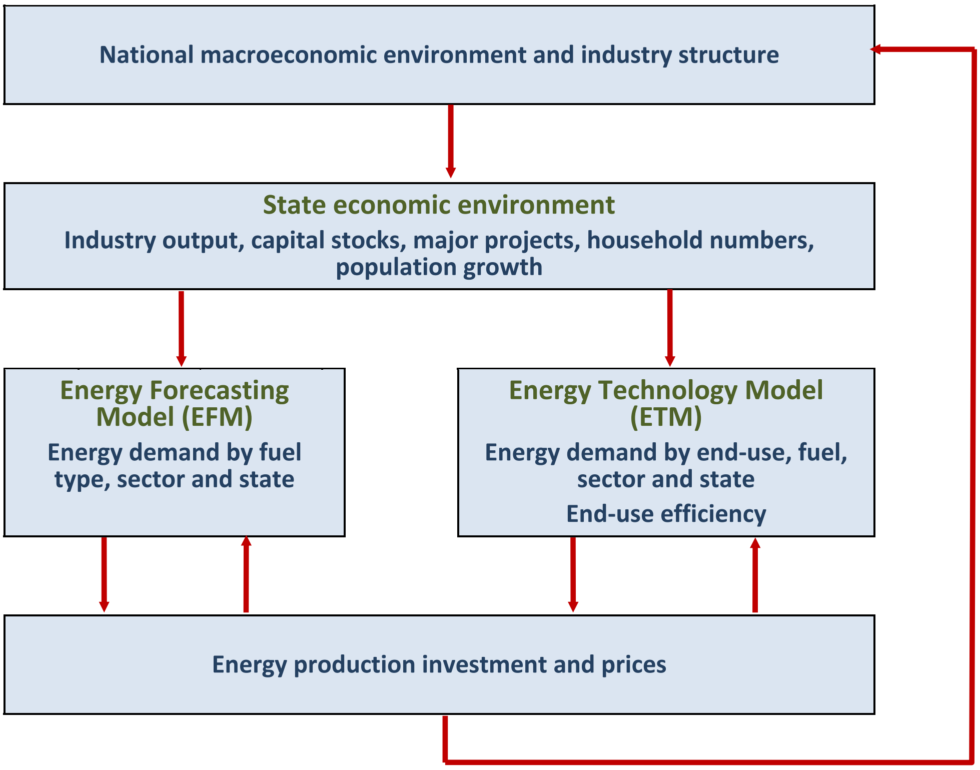


Table A.1 shows the structure of the EFM. The main structural features of NIEIR's energy forecasting modelling system are:

- primary and secondary energy is modelled at the regional (i.e. State) level;
- energy demand is modelled on an industry/sectoral basis by State (refer Table A.1);
- major energy intensive projects are explicitly taken into account;
- environmental impacts in physical and dollar terms can be estimated;
- energy prices and technological trends determine substitution between fuels in the different sectors of the economy; and
- primary fuels used in electricity generation are modelled at the State level and include specific parameters for individual power stations within each State grid.

The EFM produces detailed energy forecasts for each State and the Northern Territory. The energy consumption data contained in the EFM is largely based upon Department of Primary Industries and Energy data taken from its biennial Fuel and Electricity Survey. This data is supplemented by information from individual generating and distribution utilities, as well as detailed consumption figures from various major energy users. At present detailed energy consumption data by State, fuel type, and industry sector are updated to the financial year 2011-12.

The econometric forecasts of energy usage are based upon a large scale econometric model which relates State energy consumption to:

- state economic activity across 25 industry sectors;
- population, household size and customer numbers;
- appliance penetration and efficiency;
- real household disposable incomes;
- real energy prices;
- weather conditions; and
- major new industrial, mining and commercial developments.

The modelling approach taken explicitly identifies prospective shifts in the pattern of energy consumption induced by structural shifts in economic activity and real energy prices over the period.

The aluminium sector and other energy intensive industrial activities are explicitly identified outside the general econometric core of the model and incorporated into the forecasts by adding these demands in as identifiable items. A significant proportion of the forecast energy growth comes from major industrial/mining projects, a list of which is compiled by NIEIR. The development of each load growth scenario required decisions to be made regarding the likelihood and timing of each project included in the major industrial/mining project list. The inclusion and timing of individual projects are adjusted across the growth scenarios in a manner consistent with international and domestic demand for the various industrial and mining products.

Residential energy usage is determined by the number of households connected to the supply grid, and average consumption levels per connected household. NIEIR's forecasts of domestic customer numbers are related to population growth and household formations, while average consumption per connected household is modelled against real household disposable incomes, real energy prices, weather conditions, and domestic appliance penetration and end-use efficiency.

The econometric models provide detailed information on the relationship between electricity demand and economic activity and prices. They do not, however, provide information on the market share of individual electrical technologies nor the efficiency of these technologies.

Hence, in addition to the `tops down' econometric forecasting system, the model also includes a detailed bottoms up end use or energy technology modelling system.

Table A.1 Industry structure of the EFM

Main sectors		
1.	**Primary**	
	Division A	Agriculture
	Division B	Mining
2.	**Secondary**	Division C Manufacturing by 2-digit ASIC
	ASIC 21	Food, beverages, tobacco
	ASIC 23-24	Textiles, clothing, footwear
	ASIC 25	Wood, wood products, furniture
	ASIC 26	Paper, paper products, printing
	ASIC 27	Chemicals, petroleum and coal
	ASIC 28	Non-metallic minerals
	ASIC 29	Basic metals (iron and steel, aluminium smelting)
	ASIC 31	Fabricated metal products
	ASIC 32	Transport equipment
	ASIC 33	Other machinery and equipment
	ASIC 34	Miscellaneous manufacturing
3.	**Tertiary sectors**	
	Division E	Construction
	Division F	Wholesale and retail trade
	Division G&H	Transport and communication
		– Traction
		– Road
		– Air
		– Sea
		– Other
	Division I	Finance, property, business services
	Division J&K	Public administration, defence, community services
		– Public lighting
		– Other
	ASIC 37	Water, sewerage and drainage
	Division L	Recreation, personal and other services
4.	**Residential sector**	
5.	**Energy supply sectors**	
	Electricity generation sectors	
	Gas production and distribution	
	Petroleum refining sector	
	Briquette production sector	
	Cogeneration	
By fuel type		
1.	**Gas**	Natural gas*
		Town gas**
2.	**Electricity***	Electricity

Notes: * Includes natural gas, ethane and methane.
** Includes synthetic natural gas, reformed gas, tempered LPG and tempered natural gas.
*** Electricity consumption figures include both publicly generated and privately generated electricity.

All data are measured in petajoules which equals 10^{15} joules.

The energy technology modelling system (ETM) models State energy demand by energy service at a more aggregate level of industry structure. The main structural features of the ETM are:

- primary and secondary energy are modelled at the State level;
- energy demand is modelled on an industry basis;
- efficiencies of alternative energy end-use are renewable technologies are included by sector; and
- capital stocks, household numbers, appliance and equipment penetration ratios by sector.

Table A.2 shows the structure of the State ETM model.

Table A.2	**Energy technology model structure**	
Residential	Space heating Water heating Cooking Refrigerators Cooling Clothes dryers	Dishwashers Lighting TV/video Freezers Clothes washers Miscellaneous electric
Commercial	Heating Space cooling Ventilation and pumps Lighting Office equipment	Water heating Cooking Lifts Motive power
Industrial	Smelting Metals processing Electrolytic processing High-temperature non-metals	Low temperature heating Mechanical drivers Lighting Cogeneration
Transport	Traction Air	Road Sea