Final report to

Australian Energy Regulator

Public Version

Review of Energex's maximum demand forecasts for the 2010 to 2015 price review

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VERSION

Version	Date	Comment	Approved
1	23/09/2009	Draft to AER	MG, RL, MP
2	30/09/2009	Revised draft to AER	MG, RL, MP
3	08/10/2009	Draft for Energex review of factual errors	MG, RL, MP
Final	19/10/2009	Incorporates changes due to Energex comments	RL, MP

EXECUTIVE SUMMARY

Review of maximum demand forecasts

The Australian Energy Regulator (AER) is required to determine the revenue requirements for services provided by electricity distribution network service providers (DNSPs) in Queensland from 1 July 2010 to 30 June 2015. The National Electricity Rules require the AER to accept the forecasts of operating and capital expenditures in the DNSPs' regulatory proposals if they reasonably reflect, amongst other things, realistic expectations of demand.

The AER has engaged McLennan Magasanik Associates (MMA) to assist it by reviewing the key demand forecasts used by the DNSPs in formulating their regulatory proposals. As the Queensland DNSPs will be regulated under a revenue cap the forecasts of most concern are the maximum demand forecasts which are key inputs into capital expenditure forecasts and annual revenue requirements. The focus of the review has, therefore, been on the maximum demand forecasts, at both the system and spatial levels.

Preliminary review of approach and methodology

MMA has previously, with the cooperation of the DNSPs, carried out a preliminary review of the approaches, methodologies and data sources used by the DNSPs in their forecasting of maximum demand.

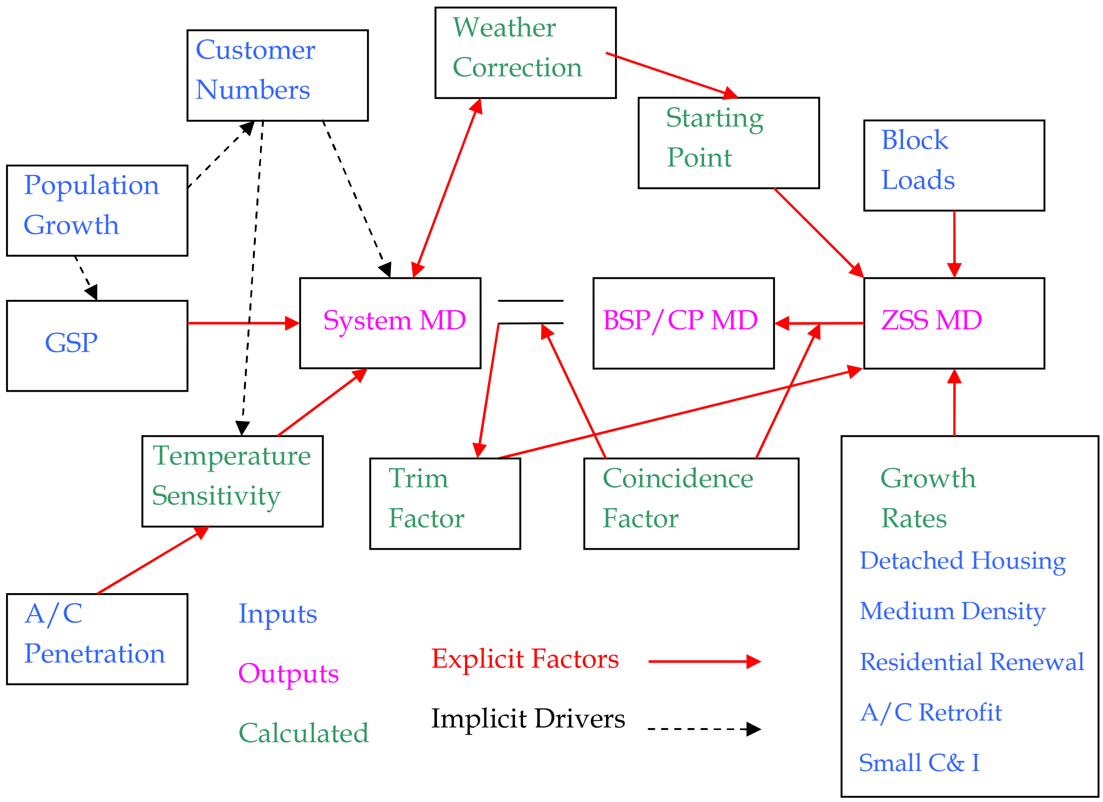
In summary at this preliminary stage MMA considered the overall Energex approach to constitute good maximum demand forecasting practice[1]. Under this approach Energex undertook:

- bottom up forecasting at the spatial (typically zone substation) level
- top down forecasting at the system level taking into account key drivers
- reconciliation of the spatial forecast to the system demand forecast through a "Trim Factor".

The Energex approaches and key inputs at both spatial and system levels and their reconciliation are shown in Figure E 1.

1 MMA defines good maximum demand forecasting practice (referred to as good practice in this report) as an approach, methodology and the application of methodology which results in realistic and reasonable maximum demand forecasts. The criteria according to which good forecasting is assessed are based on MMA's experience in reviewing, for regulators and others, a number of demand forecasts made by electricity and other utilities and also draws on work and publications by H Lee Willis, in particular H Lee Willis, "Spatial electric load forecasting", Second edition,Marcel Dekker Inc, New York, 2002.

Figure E 1 Energex's forecasting approach inputs, outputs and relationships



The main MMA concerns at the preliminary review stage were that:

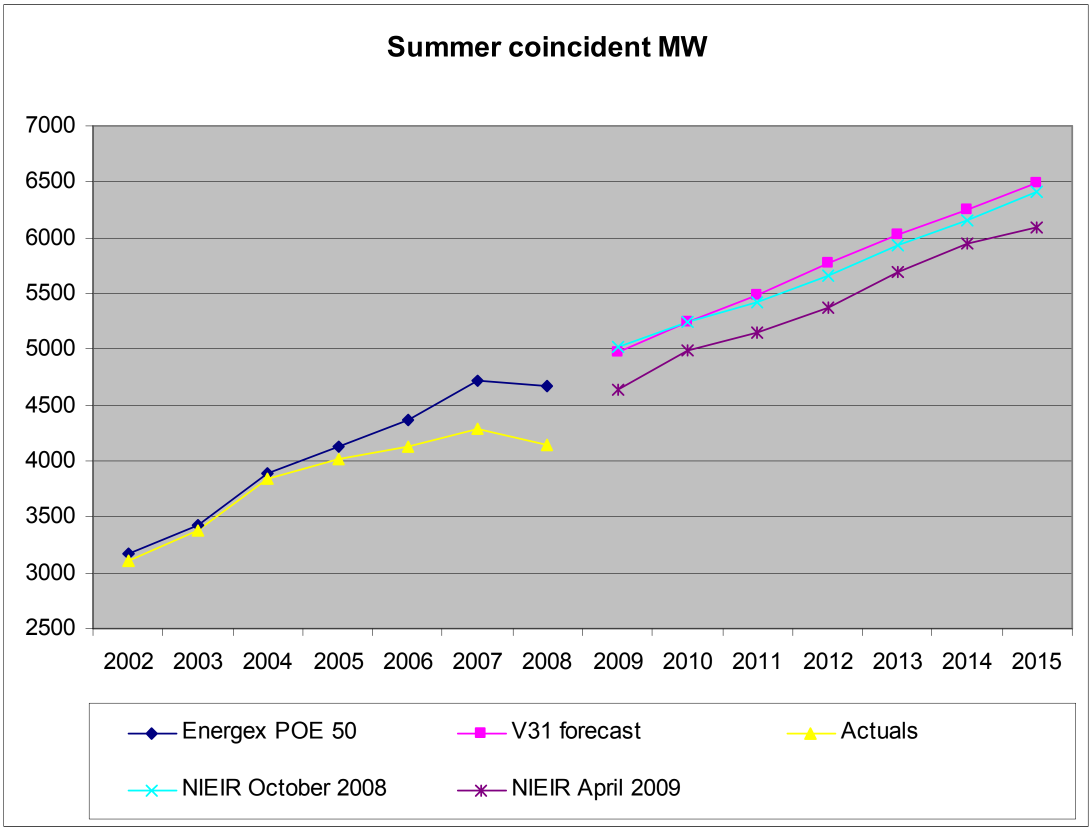
- the model used by Energex to develop its system demand forecasts (and hence the spatial reconciliation) was derived in a two stage process, with the growth in temperature sensitivity coefficients (due to air conditioning) derived independently of the GSP coefficient, and no overall validation of the two stages was undertaken. Consequently it appeared that the contributions to MD growth could have been double counted.
- the impact of the Global Financial Crisis (GFC) and the Carbon Pollution Reduction Scheme (CPRS) had not been factored into the Energex system forecasts.

Regulatory Proposal

Energex has based its detailed capital expenditure programs within the Regulatory Proposal on its V31 maximum demand forecasts prepared following the summer of 2007/08. However, Energex recognised that the changes to key drivers, resulting especially from the GFC, would be expected to have a significant impact on its maximum demand at both the spatial and system levels. As a result, Energex commissioned a study by the National Institute of Economic and Industry Research (NIEIR) which estimated

Energex's system maximum demand in April 2009. The history of system maximum demand since 2002, Energex's weather corrected (POE 50%) actuals and the Energex V31 forecasts and NIEIR forecasts from October 2008 and April 2009 are provided in Figure E 2.

Figure E 2 History and forecasts of Energex network summer coincident maximum demand, MW



Source: RIN, Energex data, NIEIR October 2008, NIEIR April 2009. Note that the NIEIR April 2009 number for 2009 is understood to be an actual value for that year.

The April 2009 NIEIR forecasts are over the period 2010 to 2015, some 6% below the Energex V31 forecasts and about 4.5% lower than the NIEIR forecasts made in October 2008. Much of the difference is expected to be due to the impact of the GFC.

In order to take account of this, Energex has in the Regulatory Proposal amended its growth capex forecasts based on the difference between its V31 and the NIEIR April 2009 forecasts as well taking into account the expected impacts of its demand management program.

Key drivers of maximum demand over the coming period

Over the period 2002 to 2007 system maximum demand grew strongly, driven largely by strong economic and population growth and very strong growth in air conditioning penetration. Mild summers in 2008 and 2009 are understood to have contributed to the lower than expected maximum demands in those years.

Over the period from 2008 to 2015 MMA forecasts a significant change in key drivers which would be expected to materially reduce maximum demand growth compared to the previous period:

- the GFC is expected to significantly reduce state economic growth, from about 5% pa between 2002 to 2008 to 2.8% pa between 2008 and 2015. This reduced economic growth will reduce growth in maximum demand, especially for business and industrial customers
- growth in air conditioning penetration will slow markedly as penetration levels approach saturation. While most new homes will be air-conditioned, there will be significantly less uptake of air conditioning by existing homes
- population and customer number growth are expected to moderate.

System maximum demand

The Energex system maximum demand forecast is very important as it is expected by Energex to be e reflective of key drivers and the spatial forecasts are reconciled to it.

In view of our initial concerns regarding the Energex MD forecast methodology, MMA has conducted tests of the Energex V31 model using historical data for the period 2001/02 to 2007/08. The tests demonstrate that the model is biased (the residuals have a strong upward trend over the data period) and less accurate than other models and we have concluded that it is not suitable for projecting system MDs.

MMA has tested a number of other potential forecasting models, including revised versions of V31 with coefficients re-estimated in such a way that the bias is eliminated and the accuracy is improved. MD projections based on our preferred model, referred to as Model B, are compared with V31 and NIEIR projections, all based on the same post-GFC GSP forecast, in Table E-1. The MMA projections are 200 to 300 MW below the Energex and NIEIR projections.

It is noted that the growth in each projection is approximately the same. From 2010 to 2015, (2010 is the first NIEIR value that is 50% PoE rather than actual) all project growth in the range 1,034 MW to 1,088 MW. The major difference between the Energex and NIEIR projections on the one hand and MMA's on the other is therefore the initial values in 2008 and 2009.

Table E-1 Post-GFC 50% POE System MD projections (MW)

	V31 model	NIEIR	Model B
2008	4,673	4,114*	4,422
2009	4,920	4,635*	4,624
2010	5,021	4,997	4,762
2011	5,073	5,144	4,882
2012	5,248	5,378	5,067
2013	5,489	5,699	5,295
2014	5,797	5,945	5,567
2015	6,055	6,085	5,828
Growth 2009 to 2015	1,135	N/A	1,204
Growth 2010 to 2015	1,034	1,088	1,066

* Understood to be actual rather than weather corrected values.

MMA has investigated a range of approaches to establishing the "correct" estimates of the weather normalised 50% PoE MD from 2002 to 2009. Unfortunately, owing to the unusually mild weather conditions, the estimates for 2008 and 2009 are the most difficult to narrow down. However using the short-term trends through 2005 to 2007 and regression analysis of the 2009 data we have concluded that the 2009 50%POE MD most probably lies in the range 4,600 MW to 4,750 MW. Allowing for year to year growth variations, we would view any projection that started in this range and grew by 1,200 MW by 2015 as being in reasonable alignment with the Post GFC GSP projections. The NIEIR April 2009 projections lie some 100 MW to 280 MW above the upper envelope of this range over the period.

Spatial maximum demand

There are several aspects to the approach taken by Energex which MMA considers to constitute good practice. These include the reconciliation of the spatial forecasts to the system forecasts, which allows changes in key drivers to be recognised, application of a threshold size to the inclusion of block loads, which acts to reduce potential double-counting and the weather correction of the ZSS starting points. While we consider the methodology actually applied to the weather correction to be flawed, we do not consider this a fatal flaw.

We note that the spatial forecasts are highly dependent on the judgment applied for future organic growth rates and this appears problematic, at least in one of the four cases we examined. While the block load forecasts we have seen also appear reasonable, this cannot be confirmed because of the lack of data available to Energex which would allow comparisons of block forecasts against actual timing and loads. There is thus the possibility that the estimates of size and timing of block loads may lead to premature or over-investment. In addition we have seen evidence that the GFC will result in delays, currently estimated to be of the order of 1-2 years, in several projects although this will differ between projects.

In general the impact of these methodological vulnerabilities is significantly reduced by the overall reconciliation to the system level MD forecasts, although this means that the system level forecasts have to be carried out rigorously and use timely inputs (see Chapter 4). The imperfections in the spatial forecasts may lead to some misallocation in the location of future demand growth but we have not seen any evidence that it results in large systematic biases in the forecasts.

Conclusions

In conclusion, MMA considers that the V31 system forecasts initially relied upon by Energex to prepare its capex forecasts are not realistic. They do not take into account the impact of the GFC and we consider the system maximum demand forecast, to which spatial forecasts have been reconciled, to be flawed.

Energex has adjusted its capex forecasts based on a forecast prepared by NIEIR in April 2009 that took into account the effect of the GFC and has also subtracted estimated impact of proposed demand management programs. The impact of the former has been to reduce the load by about 6% across the period of interest, while the latter has reduced system demand by a further average 1.2% across the period.

MMA's analysis, based on a modified version of the Energex V31 system demand model which corrects the identified flaws and re-estimates the weather correction would act to reduce demand by a further 4.5% on average below the NIEIR minus DM level.

MMA acknowledges that milder than normal conditions in 2007/08 and 2008/09 have created greater uncertainty regarding the values of the weather normalised 50%PoE MD estimates. We have estimated a most likely range of 4,600 MW to 4,750 MW for the 2008/09 value and note that our revised model estimate is 4,624 MW. If the projections are increased by the "maximum plausible" amount of 126 MW, ie the amount that sets the 2009 value at 4,750 MW, the modified model system outcomes would, after subtracting the effects of the DM program be less than the NIEIR April 2009 minus DM forecasts by some 3.5% pa on average.

Given the uncertainty, MMA considers it reasonable to estimate that even the NIEIR April 2009 minus DM forecasts which have been used to amend capex forecasts at a high level are still likely to be optimistic – by an average of some 3.5% pa or more.

MMA has concluded that the Energex V31 demand forecasts are, on average over the period 2011 to 2015, some 10.4% too high and cannot, therefore, be considered realistic. MMA also considers the NIEIR April 2009 system maximum demand forecasts, after subtracting the impacts of demand management, to also be high, by an average of 3.5% pa.

MMA has also reviewed the Energex customer number growth forecast of 2.15% pa. After taking into account expected changes in population and occupancy rates over the period, MMA considers these to be reasonable.

Finally, we note that the Australian and Queensland economies remain volatile. We have used economic forecasts for Queensland prepared in April 2009 as the basis of our analysis of system maximum demand. If there is a material change to the expected outlook then it may also materially impact on the forecasts.

1 INTRODUCTION

1.1 Background – review of revenues and prices

The Australian Energy Regulator (AER) is responsible, under the National Electricity Law (NEL) and National Electricity Rules (NER), for the economic regulation of electricity distribution services provided by distribution network service providers (DNSPs) in the National Electricity Market (NEM).

The AER, in accordance with the NER, is required to determine the revenue requirements for services provided by electricity distribution network service providers (DNSPs) in Queensland from 1 July 2010 to 30 June 2015 (the next or 2010 to 2015 regulatory control period). The relevant Queensland DNSPs are Energex and Ergon Energy.

The NER require the AER to accept the forecasts of operating and capital expenditures in the DNSPs' regulatory proposals if they reasonably reflect, amongst other things, realistic expectations of demand (refer to clauses 6.5.6(c) (3) and 6.5.7(c) (3) of the NER).

1.2 Role of demand forecasts

Demand forecasts potentially play a significant role in two components of a regulatory review:

- in determining the required capital (and to a lesser extent operating) expenditures applying to a DNSP. Capital and operating expenditures, in turn, are major inputs into the revenue required by the DNSPs over the 2010 to 2015 period.
- in determining tariffs to apply under price cap regulation (pricing proposal). Here, in simple terms, tariffs are set by dividing the required revenue stream by the forecast demand.

The two components require different but related demand forecasts. The forecasts of most relevance to capital expenditure requirements are those of maximum demand (MD) at both a system or "global" and more localised, "spatial", level. Forecasts of most relevance to determining tariffs are those related to energy and customer numbers.

The two Queensland DNSPs will be regulated under a revenue cap mechanism. As a result, the maximum demand forecasts are key inputs into capital expenditure forecasts and annual revenue requirements. Energy and customer number forecasts are significantly less important under a revenue cap. Prices are set each year to aim to recover the revenue cap; if the energy forecast is too high or low in one year, the prices are adjusted to compensate in the following year(s). The focus of the review is, therefore, on the maximum demand forecasts, at both system and spatial levels.

1.3 Review process undertaken

The AER has engaged McLennan Magasanik Associates (MMA) to assist it in its review of the key demand forecasts provided by the DNSPs with their Regulatory Proposals.

The review of demand forecasts undertaken by MMA has been a two-stage process:

- a preliminary review of approach, methods and data sources
- a detailed review of system demand forecasts and review of forecasts at selected zone substations (ZSS) at the spatial level.

1.3.1 Preliminary review of approach, methods and sources

In accordance with the NER, the DNSPs were required to submit their regulatory proposals by 1 July 2009. However, the Queensland DNSPs both agreed to a preliminary review which allowed them to describe the demand forecasting approach, methodology and data sources they proposed to use for their review and the AER (through MMA) to provide comment on the reasonableness of these.

The preliminary review served two key purposes:

- it provided the AER's consultants an opportunity to understand, in outline form, the forecasting methodology used by the DNSP prior to submission of the proposal. This facilitated the review of the forecasts after the proposals have been submitted.
- it allowed the DNSPs an early opportunity to identify whether significant issues are likely to exist with their approach to demand forecasting, and to work to address any identified issues at an early stage in the review process.

As a preliminary review is not required under the NER, participation in this was a voluntary activity for the DNSPs. As a result, the preliminary review relied entirely on voluntary provision of information by, and cooperation from, the DNSPs. Energex was very helpful in cooperating with, and providing documentation and material for, this preliminary review.

An outline of MMA's key findings from the preliminary review is provided in Section 3.4.

1.3.2 Detailed review of maximum demand forecasts

The preliminary review was undertaken in April and May 2009 and focused on the approach taken, methodology used and sources of data inputs rather than on specific forecasts at either the system or spatial levels. As a result, that review was general in nature and did not assess whether the approach and methodology have been appropriately applied. In addition, specific forecasts at either the system (global) or spatial levels were not assessed except as examples.

The detailed review of demand forecasts by MMA has been undertaken between July and September 2009, following the submission of the DNSPs Regulatory Proposals.

The review looks in some detail at the key drivers of maximum demand for the networks as a whole and the expected system wide impacts of significant changes to these drivers. It is to be expected that the system wide impacts will reflect the aggregate of the drivers that play out at the ZSS and spatial levels – which is a key driver of growth capital expenditure for the networks.

The preliminary review did not review the application of the methodology in any detail. Where judgement plays a very significant part in the forecasting process only limited understanding about methodology could be achieved prior to a review of actual history and forecasts. In order to more fully assess the methodology and whether judgements made are appropriate, four ZSS (Alexandra Headlands, West Maroochydore, Arundel and Southport) were selected in consultation with the AER for more detailed review. They were based on the planned development of two new ZSS requiring significant capital expenditure over the coming regulatory period and a review of the forecasts at the ZSS which were expected to contribute load (contributing ZSS) to these new ZSS.

MMA received the regulatory proposal documentation in early July 2009. The new ZSS to be reviewed in detail were then identified and the DNSPs were asked to prepare a history and methodology description and provide supporting data in order to allow the forecasts for the contributing ZSS to be reviewed in detail.

MMA met with the two DNSPs on the 21st and 22nd July, 2009. At the meetings the DNSPs were asked to provide a detailed description of the methodology for the contributing ZSS. Following the meeting MMA prepared a list of questions and issues which required responses from the DNSPs. Further questions, issues and requests for clarification were raised over the period to early September. Energex responded to all the questions and issues raised.

This report deals with the outcomes of the detailed review of demand forecasts submitted in the regulatory proposal. Energex has been provided with an opportunity to provide comment on the draft report about errors of fact and confidentiality and that its comments have be taken into account in this final report.

1.4 Focus on summer maximum demand

The review has focused on summer maximum demand forecasts which are the most material for the regulatory proposals of the Queensland DNSPs.

1.5 Report layout

Chapter 2 outlines the key drivers MMA considers to be relevant to maximum demand forecasts for Queensland over the period to be covered by the regulatory review – essentially 2008 to 2015. It is against this background, of expected changes to key drivers, that the forecasts have been reviewed.

Chapter 3 commences by setting out the Energex system demand history and forecasts for the coming review period. It then provides an overview of the Energex forecasting methodologies at both the system and spatial levels which were the basis of the forecasts which were used to derive the growth capex for the regulatory proposal. It then provides the key findings of the preliminary review of approach and methodology and follows these with a discussion of changes made since the preliminary review and the forecasts actually relied upon by Energex for its capital expenditure forecasts.

The maximum demand forecasts at system level are considered in detail in Chapter 4 while those at spatial level, focusing on the contributing ZSS, are reviewed in Chapter 5.

MMA's conclusions regarding the forecasts used by the DNSPs are summarised in the Executive Summary.

1.6 Conventions adopted and glossary

Unless otherwise stated, all years referred to in the report are for financial years ending June 30 of the year stated. For example, unless otherwise stated, 2010 refers to the financial year ending June 30th 2010.

We refer throughout the text to system and spatial load forecasts. System in this context refers to forecasts at system-wide or network level for the appropriate season, while spatial refers to the more local level, typically that of zone substations.

We provide a glossary of terms and abbreviations in Appendix B.

2 KEY DRIVERS OVER THE PERIOD TO 2015

2.1 Key drivers of maximum demand

In his reference text on spatial electric load forecasting, H Lee Willis has pointed out that peak or maximum demand in a utility grows for only two reasons[1]:

- new consumer additions. Load will increase if more consumers buy electricity.
- new uses of electricity by existing consumers. Existing consumers may add new appliances or replace existing equipment with appliances that require more power[2].

Similarly, any reduction of peak load growth is due to a reduction in either or both of these factors.

We consider below six key drivers of maximum demand change in Queensland and, where appropriate, the relevant Energex and Ergon Energy regions:

- economic growth
- population, dwelling and new customer growth
- growth of air conditioning penetration and usage
- changes in climate
- energy efficiency and greenhouse gas reduction measures
- the Carbon Pollution Reduction Scheme and other price impacts.

The following sections of this chapter compare changes expected in these drivers against recent history, typically the period 2002 to 2008. Unless there are significant changes to some or all of these drivers, the expectation of future growth is that it will be similar to recent growth.

In the following chapters we consider whether expected changes to key drivers have been appropriately taken into account in the forecasting methodologies used by Energex. To the extent we have considered this to not be the case we have provided an indicative assessment of the effect of incorporating these drivers on demand forecasts.

2.2 Economic growth

In assessing the general economic outlook over the next five to six years MMA has considered forecasts by the National Institute of Economic and Industry Research (NIEIR)[3] and KPMG Econtech[4].

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1 H Lee Willis, "Spatial Electric Load Forecasting" Second edition 2002, page 211.

2 To these might be added a power factor consideration although this is probably included within the second consideration and Willis only accords this a relatively low priority (Willis, page 33).

Over the past several years economic growth in Queensland has exceeded that for Australia as a whole. Between 2002 and 2008 the Queensland economy, as measured by Gross State Product (GSP), grew by 5% pa, significantly higher than the Australian economic growth rate of 3.3% pa.

In 2007 and 2008, when forecasts by the networks for the coming regulatory period were being prepared, the outlook for growth in Queensland was still strong. NIEIR's October 2008 forecast of growth in Queensland GSP over the period 2008 to 2015 was some 4.2% pa[5]. In October 2008 KPMG Econtech was forecasting Queensland GSP growth to average some 5% pa over the period 2008 to 2015, in line with recent growth[6].

However, as a result of the GFC, by the April 2009 NIEIR forecasts, the outlook had changed substantially. At that time NIEIR forecast that the Australian economy would experience negative growth in 2009 and 2010, show only slightly positive growth in 2011 and rebound more strongly in 2012 and 2013, growing by some 4% to 5%. While such growth rebound is typical for recovery years, NIEIR forecast that the relatively high growth rates would not be sustained with economic growth for Australia forecast to reduce to 3% by 2014 and 0.6% by 2015 as the economy contracts in order to control the current account deficit. Overall, Australian GDP was forecast by NIEIR to grow at some 1.8% over the period 2008 to 2015.

The NIEIR forecast was somewhat brighter for Queensland. In April 2009, NIEIR forecast Queensland GSP to increase by 1.1% in 2009, and then fall by 0.2% in 2010. A recovery in GSP growth in Queensland was forecast to occur from 2011, when growth was projected to be 3% increasing to 4.6% in 2012, 6.0% in 2013 and 4.5% in 2014 before reducing to 1.1% in 2015, in line with contraction forecast across Australia[7]. On average, Queensland GSP was forecast to grow by 2.8% pa over the 2008 to 2015 period. While this is still stronger than the Australian economy as a whole, it is some 50% to 60% of the growth experienced over the period 2002 to 2008.

The most recent (August 2009) KPMG Econtech report[8] forecasts a very strong downturn, a contraction by 4.8%, for the Queensland economy in 2009. The three key components to this downturn were reduced consumer spending, the "demise" of the local property market and the decline in mining investment. Growth in 2010 is forecast to remain weak at 1.4%. Over the longer term from 2011 to 2015, stronger growth averaging over 3.5% pa is expected to resume with continued population growth and recoveries in the commodities and property markets. Even this is only some 70% of the growth rate experienced between 2002 and 2008. However, over the entire period of interest, 2008 to

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3 National Instiute for Economic and Industry Research in various reports to Energex and Ergon Energy from 2007 to 2009 including report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2019", April 2009.

4 KPMG Econtech, "Australian National State and Industry Outlook" various issues.

5 NIEIR report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2018", October 2008..

6 KPMG Econtech, "Australian National State and Industry Outlook" October 2008.

7 While NIEIR's forecast for 2015 appears particularly pessimistic, KPMG Econtech is also forecasting a slow-down to 2.7% growth in that year.

8 KPMG Econtech, "Australian National State and Industry Outlook" , August 2009.

2015, Queensland growth is expected by KPMG Econtech to average only 2% pa – less than half what it averaged over the earlier period.

Economic growth is considered to be a key driver of growth in maximum demand, especially in the business sectors. It is, for example, often used as a predictor of non-residential energy consumption and is a key input in global maximum demand models, including that of Energex[9]. It clearly also has a significant impact on the NIEIR forecasts, with the GFC resulting in a significant reduction in both GSP and maximum demand growth forecast by NIEIR for the Energex region between October 2008 and April 2009 (see Section 3.5).

MMA considers that the very significant expected reduction in Queensland economic growth, from 5% pa over the period 2002 to 2008 to a forecast 2-3% pa over the period of 2008 to 2015 needs to be taken into account when forecasting maximum demand growth over the period of concern.

2.3 New customer growth

Each additional new customer can be expected to add growth to both spatial and system peak demand, estimated by the peak demand of that customer multiplied by the appropriate coincidence factor[10].

Both the population and number of dwellings in Queensland have been growing strongly and these are also understood to have played a part in the growth in maximum demand.

While the rates of growth of population and household formation are still expected to remain reasonably strong, and more so in Queensland than in most other states, these might be tempered by the employment slow-down due to reduced commodity prices and hence employment and expected reduction in overseas migration.

2.3.1 Queensland population growth

Over the period 2002 to 2008, Queensland population grew at a rate of about 2.4% pa[11] due largely to growth in overseas migration. As with economic growth, this population increase is significantly greater than that for the Australian population as a whole (about 1.5% pa over that period) reflecting the high economic and employment growth experienced in Queensland over these years. It is also significantly stronger than the rate of growth seen in Queensland over the period 1996 to 2002 of 1.9%.

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9 McLennan Magasanik Associates report to the Australian Energy Regulator, "Pre-Submission Review of Energex's Demand Forecast Methodology", 18 May 2009, page 19.

10 The coincidence factor needs to take into account the level of aggregation (eg zone substation, transmission substation or network) and the time of maximum demand (eg summer day or summer night) and associated levels of coincidence.

11 Australian Bureau of Statistics 3101, Demographic Statistics, December 2008.

In April 2009, NIEIR[12] projected population growth in Queensland to moderate to about 2% pa over the period 2008 to 2015. The NIEIR population forecast for Queensland as a whole is shown in Table 2-1.

Table 2-1 NIEIR population projection growth rates for Queensland (% pa)

Year	Population ('000)	Annual Growth
2006	4,202.66	2.4%
2007	4,305.96	2.5%
2008	4,410.21	2.4%
2009	4,514.29	2.4%
2010	4,610.59	2.1%
2011	4,701.16	2.0%
2012	4,786.89	1.8%
2013	4,876.44	1.9%
2014	4,970.55	1.9%
2015	5,069.59	2.0%
2016	5,165.67	1.9%
2017	5,270.66	2.0%
2018	5,382.51	2.1%
2019	5,498.43	2.2%
2008-2015		2.0%

Source: NIEIR[13]

NIEIR had expected a slight reduction in population growth even prior to the GFC. In an October 2008 report[14] to Energex it had forecast Queensland population growth to moderate to about 2.1% pa as the Queensland economy and employment growth slowed. The impact of the GFC on population growth is presumably expected by NIEIR to further reduce population growth by some 0.1% pa over the period 2008 to 2015.

The forecast growth of 2.1% pa is in line with the middle population projection for Queensland produced by the Australian Bureau of Statistics (ABS) in September 2008 which forecast growth between 2008 and 2015 of 2.1% pa. The ABS projections are shown in Table 2-2. The ABS high growth scenario (Series A) and low growth scenario (Series C) projected population growth of 2.6% pa and 1.7% pa respectively.

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12 NIEIR report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2019", April 2009.

13 NIEIR report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2019" April 2009, page 21.

14 NIEIR report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2018", October 2008.

Table 2-2 ABS population projection growth rates for Queensland (% pa)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2008-2015
Series A	2.2%	2.3%	2.5%	2.6%	2.6%	2.6%	2.6%	2.5%	2.5%	2.6%
Series B	2.2%	2.2%	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%	2.0%	2.1%
Series C	2.2%	2.1%	2.0%	1.8%	1.7%	1.7%	1.7%	1.6%	1.6%	1.7%

Source: ABS, *Population Projections Australia*, 4 Sep 2008.

By contrast, the population growth projected by KPMG Econtech is significantly more bullish for Queensland. In its report to NEMMCO[15] as well as in the August 2009 issue of its quarterly *Australian National, State and Industry Outlook*,[16] KPMG Econtech noted that Queensland is a "rapid population growth state". In the latter publication KPMG Econtech forecast that over the three years to 2010/11, the Queensland population would grow by 2.8% pa[17]. This is well above the 2% growth rate expected of Australia as a whole and is significantly higher than the NIEIR and ABS projections. It is also higher than the forecast that KPMG Econtech provided to NEMMCO in March 2009 when it forecast a growth rate for Queensland of 2.2%[18].

On balance we consider the NIEIR and middle ABS forecasts to be more likely outcomes.

2.3.2 Population growth in network regions

The NIEIR forecasts prepared for both Energex and Ergon Energy also allow comparison of population growth rates for populations in the regions served by the networks – essentially south east Queensland for the Energex network and the rest of Queensland for Ergon Energy. The population in the south east Queensland region covered by the Energex network has been growing at a rate materially greater than has population in the Ergon Energy region, some 2.6% pa versus 2.1% pa over the period 2002 to 2008. NIEIR projects the disparity in population growth rates to continue, with population in the Energex region forecast to grow at some 0.2% pa more than across the state as a whole and in the Ergon Energy region some 0.4% or 0.5% less than for the state as a whole. According to the April 2009 NIEIR forecasts, population growth in the Energex region between 2008 and 2015 is forecast to be some 2.2% pa and in the rest of Queensland some 1.6% pa. This is consistent with recent history.

15 KPMG Econtech, *NEMMCO Ltd Stage 2: Economic Scenarios and Forecasts for the NEM Regions 2008-09 to 2028-29*, March 2009.

16 KPMG Econtech, *Australian National State and Industry Outlook*, 20 August 2009.

17 KPMG Econtech, *Australian National, State and Industry Outlook 20 August* 2009.

18 KPMG Econtech, *NEMMCO Ltd Stage 2: Economic Scenarios and Forecasts for the NEM Regions 2008-09 to 2028-29*, March 2009.

2.3.3 Dwelling numbers

Dwelling numbers in Queensland have been growing at about 2.3% pa between the 1996 and 2006 censuses. The census details for total and occupied private dwellings are provided in Table 2-3 as well as populations and a calculated number of persons per total dwellings (ppd) in each of the years.

Table 2-3 Total and occupied private dwellings, population and persons per dwelling in Queensland

Census	Total dwellings	Occupied dwellings	Population	Ppd
1996	1,325,559	1,204,072	3,355,031	2.53
2001	1,482,912	1,355,613	3,649,488	2.46
2006	1,660,750	1,508,522	4,114,858	2.48

Sources ABS Cat. No. 2068.0 - 2006 Census Tables.

Dwelling growth is a combination of population growth and changes in persons per dwelling known as the occupancy rate. The occupancy rate has been reducing over recent years across Australia and was generally expected to continue doing so. For example, between the 1996 and 2001 censuses the rate of growth of occupancy rate in Queensland was some -0.6% pa[19]. The combination of population growth of 1.7% pa and a reducing occupancy rate of -0.6%pa resulted in the observed dwelling growth rate of 2.3% pa.

However, between the 2001 and 2006 censuses the occupancy rate in Queensland actually increased. Thus the same observed dwelling growth rate (2.3% pa) was the result of a combination of a higher population growth rate (2.4% pa) together with an increasing occupancy rate (0.1% pa).

In the years 2007 and 2008, there has been a similar outcome to that seen between 2001 and 2006. The gross growth rate in dwelling completions[20] has been about 2.4% pa, while the estimated Queensland population growth rate between June 2006 and June 2008 has been about 2.5% pa.

A number of reasons have been suggested for the change in occupancy rate growth from negative to flat or positive between 1996 and 2006, including the high cost of accommodation, lower divorce rates and increase in fertility. However, the underlying causes and the direction of occupancy rate growth over the period to 2015 remain unclear.

NIEIR's April 2009 forecasts of dwellings and population provide an expectation that the occupancy rate will stay approximately constant over the period 2008 to 2015 for Queensland as a whole. MMA considers this to be a reasonable expectation. However, NIEIR does differentiate between the Energex and Ergon Energy regions. While the occupancy rate for Energex is expected to remain flat, that for Ergon Energy is expected to reduce slightly, by some 0.2% pa.

[19] Calculated as Queensland population divided by Queensland Total Private Dwellings.
[20] ABS, 8752.0 Building Activity, Australia.

As a result, the NIEIR forecasts over the period 2008 to 2015 are for dwellings in the whole of Queensland to grow at 2.1% pa, with growth in the Energex region being 2.2% pa (about the same as population growth) and 1.8% pa in the Ergon Energy region (a little higher than population growth).

2.3.4 Customer number growth

Network customer numbers are dominated by residential customers. It is therefore to be expected that the rate of growth of network customer numbers would approximately equal the rate of growth of dwellings.

According to the Regulatory Information Notice (RIN) numbers provided by the DNSPs, over the period 2002 to 2008 total customer numbers grew by about 2.4% pa, approximately the same rate as the rate of growth of dwellings (which is consistent with population growth, given that the occupancy rate was approximately steady over the period).

However, as for population growth, the customer growth rates have been somewhat uneven across the state, with total customer numbers provided in the RINs growing by 2.5% pa for Energex and a lower amount for Ergon Energy.

According to the RIN, Energex is forecasting customer numbers to grow at 2.15% pa over the period 2008 to 2015. This growth rate is consistent with the growth in dwellings forecast by NIEIR in April 2009 of 2.2% pa, which is, in turn, made up of a population growth of 2.2% pa and a flat occupancy rate. Given that MMA considers both of these to be reasonable and the strong connection between residential customer number growth and dwellings, MMA considers the customer number forecasts of Energex to be reasonable.

2.3.5 Ramifications for customer number growth as a key driver

As stated above, each new customer can be considered to represent an additional new load for the network[21]. Based on the above analysis, the growth rate in customer numbers expected from 2008 to 2015 will be a little lower in percentage terms than the growth rate seen recently – some 2.15% pa for Energex against 2.5% over 2002-2008.

While this is a reduction in percentage terms, in linear terms the increases in customer numbers is expected to remain reasonably steady.

Overall, the impact of additional customer numbers can be expected to remain about the same as, or slightly less than, the impact of customer number growth over recent years.

[21] For example, at an indicative after diversity maximum demand (ADMD) of 2 kW at system level for a new customer, a residential customer growth rate of 2.5% pa will result in an average annual increase of 62 MW pa in system MD over the period 2008 to 2015 compared with an average annual increase of 52 MW for the Energex assumed growth rate of 2.15% pa. A difference of 10 MW is about 3-4% of the expected annual system MD growth rate.

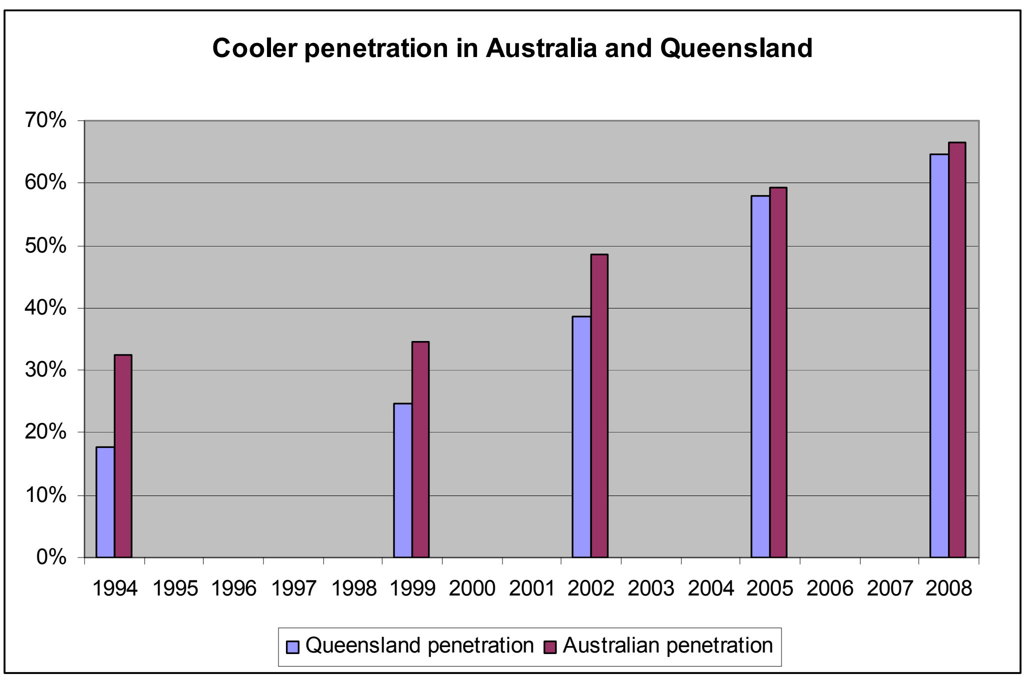
2.4 Air conditioning growth

2.4.1 Penetration of air-conditioners in Queensland

The Australian Bureau of Statistics (ABS) has been collecting survey data on air-conditioner penetration across Australia since 1994 in its 4602 series, "Environmental issues: people's views and practices". The dates of the surveys with relevant air-conditioner data have been June 1994 and March 1999, 2002, 2005 and 2008. The most recent publication in the series, relating to the March 2008 survey, was published in November 2008[22].

The proportion of dwellings with coolers in Australia and Queensland is shown in Figure 2-1. Penetration of air conditioning in Queensland and Australia has grown very strongly over the period 1994 to 2008. While the penetration rate in Queensland commenced at a lower level than that seen across the rest of Australia, since 2005 it reached approximately the same level as that seen across Australia. This means that the penetration rate of households with air-conditioners has increased more quickly in Queensland than it did in Australia as a whole over that period.

Figure 2-1 Proportion of dwellings with coolers in Australia and Queensland, 1994 to 2008



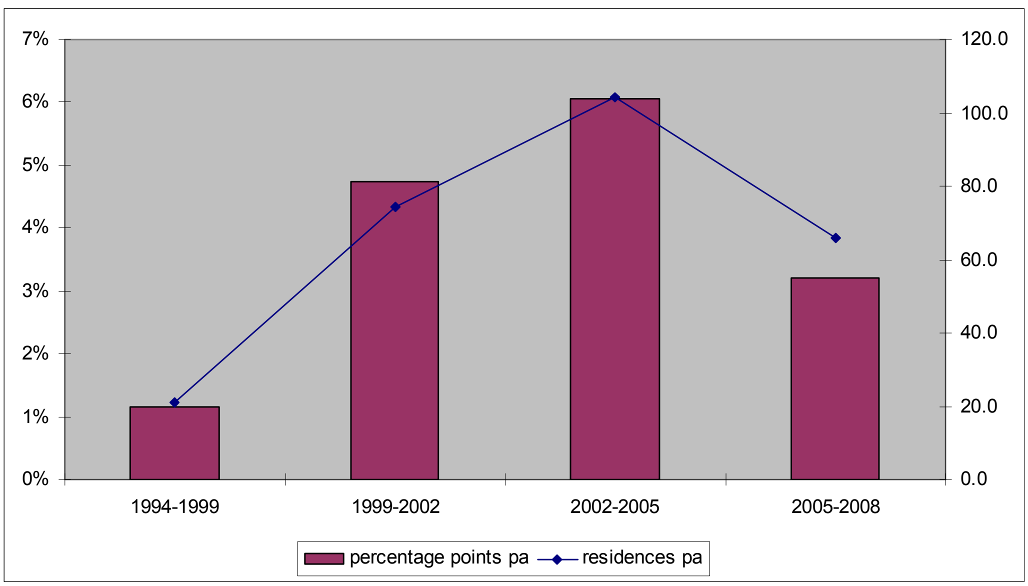
Source ABS 4602.0.055.001. Note that the series includes evaporative air coolers.

22 Australian Bureau of Statistics, Publication 4602.0.55.001, "Environmental issues: energy use and conservation, March 2008" published November 2008.

The above series includes evaporative air coolers. As evaporative coolers consume significantly less energy than do the reverse cycle and refrigerative air coolers, they are of less interest in terms of maximum demand than these other types of coolers. Over the past decade there has been a decline in evaporative air coolers which means the rate of increase of non-evaporative air-conditioners is understated in the above Figure.

Figure 2-2 shows the average annual growth in penetration rate of non-evaporative air-conditioners in Queensland over the periods 1994 to 1999, 1999 to 2002, 2002 to 2005 and 2005 to 2008. The columns illustrate the average percentage point growth pa (growth in penetration rate over the period divided by the number of years) and use the left hand axis. The "residences pa" line shows on the right hand axis the average number of additional homes per year, in '000s, which installed air conditioning for the first time over each survey period. This latter measure takes into account the growing number of dwellings in Queensland.

Figure 2-2 Average annual growth in penetration rate between survey periods (percentage points pa) and number of additional homes with non-evaporative air conditioning each year, '000.



Source ABS 4602.0.055.001.

According to the ABS, the penetration rate of non-evaporative air conditioning in Queensland increased slowly (by about 1 percentage point pa) between 1994 and 1999 but then grew very rapidly at around 5.5 percentage points pa between 1999 and 2005. This coincided with a strong increase in maximum demand. However, the growth slowed quite significantly over the period 2005 to 2008 as the penetration rate started to approach saturation level. Over the period 2005 to 2008 the average growth rate was 3.2 percentage points pa, about 60% of that seen over the previous two periods.

There has also been a significant reduction in the number of additional houses with air-conditioners, which is considered a key driver of maximum demand growth, although not as pronounced as the reduction in percentage point growth rates. Between 1999 and 2005, about 90,000 additional dwellings gained air conditioning each year[23]. Between 2005 and 2008, this reduced to 66,000 pa, about three quarters of the growth seen over the previous periods.

A similar conclusion in terms of penetration rates can be drawn from the following diagram reproduced from the Powerlink Annual Planning Report 2009[24].

Figure 2-3 Number of residences with air-conditioners in Queensland and south east Queensland

Source: Powerlink APR 2009.

Reading from the graph, for Queensland as a whole, over the six years between May 2002 and May 2008 the penetration rate increased from about 38% to about 69% - an increase in penetration of about 5 percentage points pa. However, growth in penetration was definitely more rapid in the early years of the period. Between May 2002 and May 2005 penetration increased from about 38% to 59% (7 percentage points pa) while from May 2005 to May 2008 the rate grew at only just over 3percentage points pa. Very similar estimates are applicable to south east Queensland.

23 This is a combination of new homes and existing homes which install air conditioning for the first time.

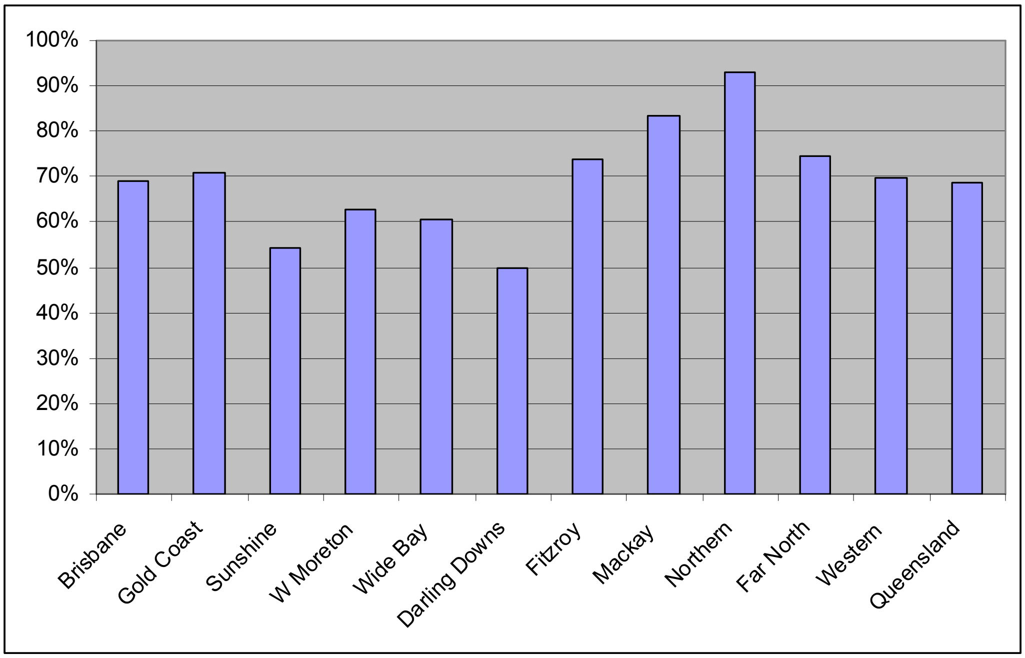
24 Powerlink Queensland, "Annual Planning Report", 2009, page 110.

2.5 Regional distribution of air-conditioners

The Queensland Government through the Office of Economical and Statistical Research (OESR) has over the past few years carried out surveys of Queensland households which assess levels of air conditioning and other appliances at a regional level. We believe the Powerlink figure shown in Figure 2-3 above is derived (at least in part) from these surveys.

The penetration of air conditioning (excluding evaporative cooling) in May 2008, by region and for Queensland as a whole according to the May 2008 OESR survey[25] is shown in Figure 2-4.

Figure 2-4 Air-conditioner penetration by statistical region, May 2008



Source: OESR May 2008.

As can be seen, the air-conditioner penetration rate for Queensland as a whole by May 2008 was approaching 70%. Air-conditioner penetration is highest in the Northern, Mackay, Fitzroy and Far North regions of Queensland, each with penetration of over 70% and lowest on the Sunshine Coast and Darling Downs.

Although MMA does not have long-term historical information about the regional distribution of air conditioning penetration of air-conditioners, from survey penetration information supplied by Ergon Energy[26] the growth rate over the period 2004 to 2008 has averaged around 5 percentage points pa in most parts of Queensland and somewhat lower, around 3 percentage points pa in the parts of Queensland with high existing

[25] Queensland Office of the Government Statistician, "May 2008 Queensland Household Survey".

[26] Ergon Energy AR540, "Air conditioning penetration trend QHS additional" provided with the public attachments to the Ergon regulatory proposal.

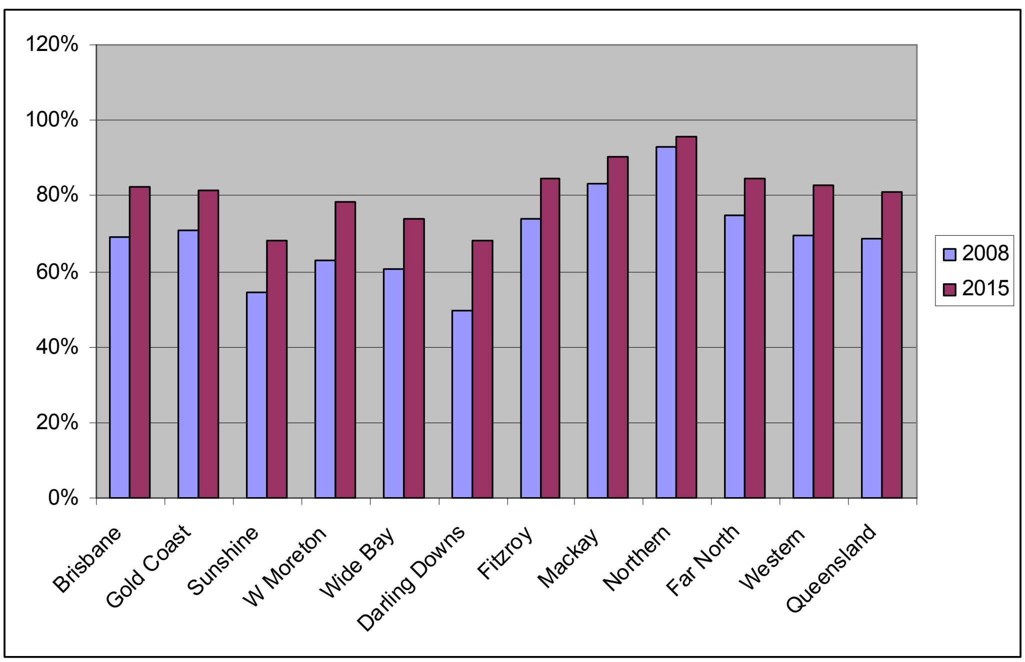
penetration rates. The slower growth rates observed in areas with already high penetration is understandable as the air-conditioner levels in those regions start to approach saturation.

2.6 Indicative levels of penetration saturation

The OESR surveys asked respondents without air conditioning about their intention to purchase air conditioning and the time frame for any such purchase. By using the number who responded that they intend to never purchase air conditioning together with expected new customer growth rates, an estimate can be made of the ultimate penetration rate for existing homes. These ultimate penetration rates for existing homes range from a high of 94% in the Northern statistical region to 58% on the Sunshine coast.

However, on the expectation that most new dwellings will have air conditioning, and that the proportion of those who expect to never have air conditioning will reduce over time[27], an estimate can be made of the expected ultimate penetration by region by the year 2015[28]. This estimate is illustrated in Figure 2-5.

Figure 2-5 Current level of air-conditioner penetration by region and expected saturation level in 2015



27 Because householders change their minds or move home or the dwellings get demolished.

28 We have assumed household number growth by 2.2% in the Energex regions in line with the RIN forecasts but 1.8% pa in the Ergon Energy regions which is a little higher than the 1.6% pa in the Ergon Energy RIN forecasts. We have also assumed that almost all of the new customers have air conditioning and that the number of customers who say they will "never" get air conditioning reduces by 2% pa.

2.7 Estimated average annual growth rates in air-conditioner penetration and households with air conditioning

MMA's projections of penetration of households with air conditioning and number of air conditioned houses by 2015 in the Energex and Ergon Energy networks and for Queensland as a whole are provided in Table 2-4. The Table also provides estimates of comparable numbers in 2004 and 2008 and provides estimated growth in these parameters over the period 2004 to 2008 and 2008 to 2015.

Table 2-4 Air condition penetration (%) and number of air conditioned houses ('000) and growth in penetration (percentage points pa) and air conditioned houses

	Energex			Ergon Energy			Queensland		
	2004	**2008**	**2015**	**2004**	**2008**	**2015**	**2004**	**2008**	**2015**
Air-conditioner penetration	47%	68%	81%	56%	71%	82%	50%	69%	81%
Houses with air conditioning ('000)	454	715	992	266	365	470	720	1,080	1,462
Growth over the period		**2004-2008**	**2008-2015**		**2004-2008**	**2008-2015**		**2004-2008**	**2008-2015**
Penetration – percentage points pa		5	1.8		4	1.6		5	1.7
Air conditioned houses ('000)		65	40		25	15		90	55

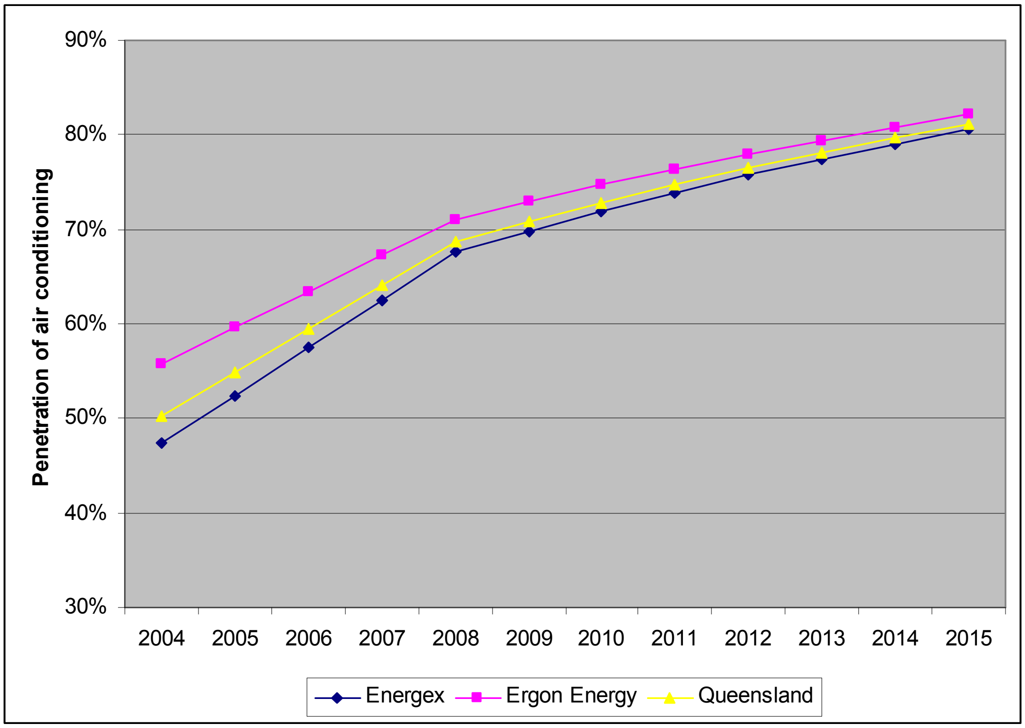
Over the period 2004 to 2008 air-conditioner penetration grew by an estimated 4 to 5 percentage points pa across Queensland, a little slower for Ergon Energy than for Energex. This is about the same rate of penetration growth as seen between 1999 and 2002 but slower than the rate from 2002 to 2005.

However, the level of penetration appears to be approaching saturation. We project saturation levels by 2015 to average about 81% to 82% of all homes across Queensland. Given that average penetration levels were about 69% in 2008 this means that the increase from 2008 to 2015 will only average about 1.5 to 2 percentage points pa over the entire period – significantly slower than the 4-6 percentage points average annual increase seen over the period 1999 to 2008.

In terms of absolute growth in houses with air conditioning, the expected reduction in new growth is a little less, with newly air conditioned houses across the state growing at about 55,000 pa over the period 2008 to 2015 compared to about 90,000 pa over the period 2004 to 2008 – a reduction of some 40%. Note, however, that in terms of the rate of growth of housing with air conditioning this equates to an expected growth rate of 4% to 5% pa, down from about 8% to 12% over the previous period.

The average penetration growth rate for Energex is projected to be 1.85 percentage points pa over the period 2008 to 2015, while that for Ergon Energy is projected to be a little lower at 1.6 percentage points pa. We consider it reasonable to adopt a straight line approach to number of additional houses with air conditioning over time, meaning that the growth in penetration rate declines over the period. The average penetration rates over the period 2004 to 2008 and MMA projections of penetration rate are illustrated in Figure 2-6.

Figure 2-6 Penetration rate of air conditioning in Queensland and the network areas



Note: trend growth rates over the period 2004 to 2008 and MMA estimates from 2008 to 2015.

2.7.1 Impact of reduced growth in air conditioning penetration

Given that the number of new homes being built is expected to remain about the same as it has over the past several years (see Section 2.3), and that most of these are expected to have air conditioning, this means that the number of existing homes which become air conditioned for the first time is expected to drop very significantly when compared to the previous period. We estimate the reduction to be from over 42,000 existing homes in the Energex region taking on air conditioning each year between 2004 to 2008 to only 16,500 existing homes doing so between 2008 and 2015 – a reduction of some 60%. The comparable numbers for Ergon Energy are an average of almost 16,000 existing homes taking air conditioning each year for the first time between 2004 and 2008 compared to an average 5,100 between 2008 and 2015, a reduction of almost 70%.

If we indicatively assume that the fully diversified air conditioning load is some 1 kW per household (MMA interpretation of data provide by Energex)[29] then it would reduce trend growth by of the order of 26 MW pa for Energex (about 10% of recent trend growth) and over 10 MW pa for Ergon Energy.

2.7.2 Considerations other than penetration

A multitude of other factors can be taken into account when trying to assess the likely contribution of cooling to maximum demand over the coming period, including:

- increasing size of air-conditioners
- increasing numbers of air-conditioners in households
- increasing house size
- increasing efficiency of air-conditioners
- improving thermal efficiency of houses (including additional insulation as part of the stimulus package)
- air-conditioner saturation effects
- increased price of electricity, including effect of the CPRS (see Sections 2.8 and2.10)
- effect of the GFC and stimulus package on installation and use of air-conditioners
- climate impacts
- increased energy and greenhouse awareness.

These, and other factors, are often included in an assessment of trend changes over time but are very difficult to model with any accuracy separately. On balance we consider that changes to these are likely to be similar to those experienced over recent periods and that these are secondary compared to the expected changes in air-conditioner penetration rate.

2.8 Climate change

Weather, mainly temperature but also humidity, wind and other factors, has a strong influence on electricity demand variation from hour-to-hour and day-to-day. Peak summer demand is associated with high temperatures and a significant amount of variation in peak demand from year-to-year is due to differences in peak temperatures. To estimate underlying peak demand growth rates it is necessary to correct for the temperature differences, for example by calculating demand temperature sensitivity and estimating demand at a standardised peak temperature with a given probability of occurring.

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[29] See for example the internal Energex report by Mark Patterson, "Residential a/c in South East Queensland" for Energex answer to MMA question 18 which is quoted in the Energex Regulatory Proposal , Appendix 10.1 "Peak Demand and Energy Forecasts 2009-2015", page 21.

Weather sensitivity also suggests that peak demand will change in response to global warming, though the global warming induced changes in peak temperatures are likely to be small in comparison to variations from year-to-year. More significant global warming induced changes to peak demand may result from changes in the duration of hot weather, such as the 16 consecutive days over 35 C experienced in Adelaide in March 2008, which resulted in new demand peaks in South Australia. However, the probability of such events is insufficiently quantifiable for inclusion in forecasts at present.

There is no evidence of any increase to peak temperatures in Queensland over recent years. Indeed, over the past 4 years since 2004/05 south east Queensland at least has experienced a range of summers[30] but, according to Powerlink, only limited very hot days on working days - resulting in the maximum demand for the Energex network being lower than expected.

According to Powerlink, the number of days in summer which have achieved a greater than 90% POE temperatures (ie a temperature which would be expected to be exceeded in 9 out of 10 summers) is shown in Figure 2-7, reproduced from the Powerlink 2009 APR[31]. Although the label caption refers to a "recent trend to a lower number of very hot summer days across Queensland", it is not apparent from the Figure that such a trend exists. The 90% POE temperature is by definition expected to be exceeded in 9 years out of 10 – and from the Figure is exceeded in 10 years out of 12 for all stations reported, which is unexceptional[32]. While the last two years appear to have been mild in terms of less than average very hot days, especially on working days, this may well be by chance.

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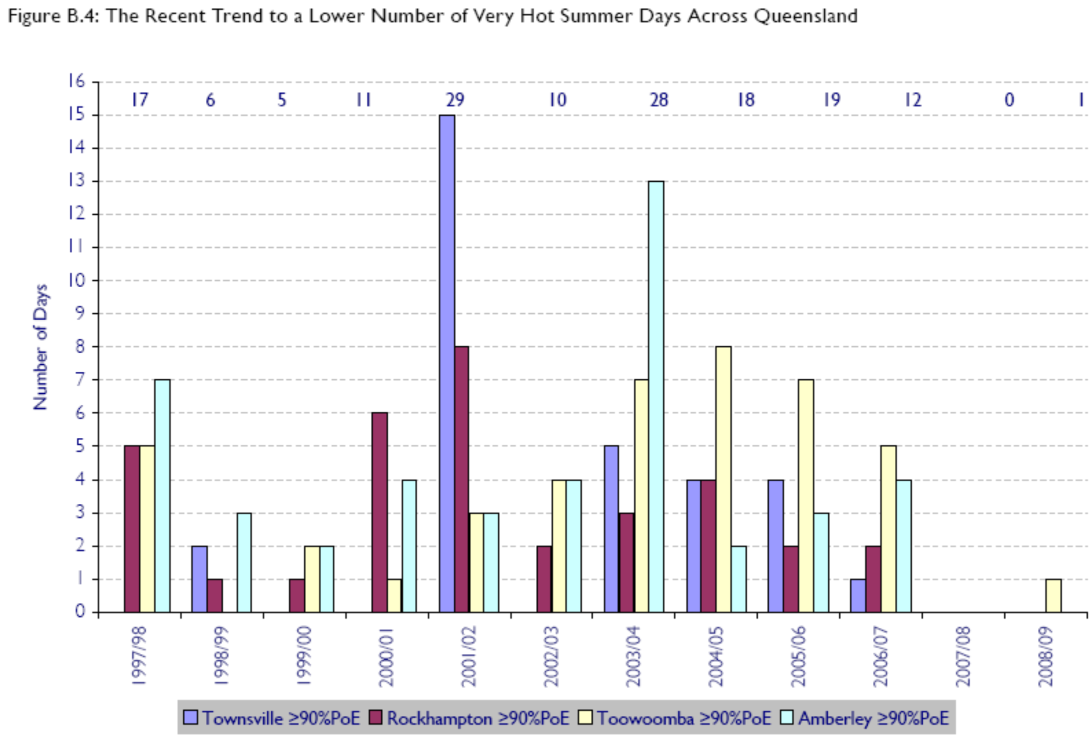
30 According to Powerlink, prevailing south east Queensland weather conditions were average in 2004/05, very hot in 2005/06 but with a lack of very hot working days and mild to average with a limited number or lack of hot days in 2006/07, 2007/08 and 2008/09. Powerlink Annual Planning Report 2009, page 26.

31 Powerlink Annual Planning Report 2009, page 109.

32 In addition, Table 3.4 of the Powerlink Annual Planning Report 2009, page 26 provides details of working and non-working days which exceeded 30C , the 50% POE temperature at Amberley,the weather station used for south east Queensland weather correction. According to that Table this temperature was exceeded in 8 of 11 years and on working days in 6 of11 years. Both of these appear to be unexceptional for a temperature which should be exceeded only 1 year in 2.

Figure 2-7 Number of hot summer days across Queensland



Source: Powerlink Figure B.4.

The mild weather over the past two summers does, however, raise some potential difficulty with using 2007/08 and 2008/09 data, especially if trend analysis is used as a main forecast tool. In such a case the 2006/07 summer appears to be a more appropriate year to use as a starting point, although this may not pick up any genuine changes in trend in those two years. Further discussion on the difficulties created by the mild weather in 2007/08 and 2008/09 is presented in section 4.2.

2.9 Carbon Pollution Reduction Scheme

The Federal Government intends to introduce the Carbon Pollution Reduction Scheme (CPRS) from 1 July 2011. According to the Government's White Paper, the CPRS is expected to increase electricity prices to households by about 18 per cent and gas prices by about 12 per cent[33], although the full effect of this will likely not be felt until 2012/13 as the carbon price is capped at $10/t until then.

While a significant increase in electricity prices is sometimes expected to impact almost exclusively energy (and not on maximum demand), research in South Australia suggests this is not the case.

[33] Australian Government White Paper, *Carbon Pollution Reduction Scheme, Australia's Low Pollution Future, Vol 2,* Dec 2008, page 17-3. In fact, the full sentence, in the section "Impact of the scheme on households" reads "Electricity prices are estimated to increase by around 18 per cent and gas prices by 12 per cent."

Over the past two years Monash University Business and Economic Forecasting Unit has created new approaches to forecasting peak demand for South Australia for ESIPC, including the use of summary econometric models to estimate the GSP and price sensitivity of energy and summer and winter 10% POE peak demands. The outcomes of this modelling are summarised in ESIPC's 2008 APR[34]:

"*Historic and forecast levels of customer sales and the summer and winter 10% POE levels have been used to identify summary econometric models and estimate the price and income elasticity of each electricity variable. Currently, back-cast peak demand POE levels have been used rather than the forecasts prepared in earlier years. These models are different from those used to develop the forecasts and should be regarded as part of a post-forecast review rather than forecasting models per se. Nevertheless, they provide a good basis to identify the sensitivity of the forecasts to the key assumptions about GSP and price. Regression results show a price elasticity of minus 0.28*[35] *for sales (with a lag of one year), minus 0.23 for the summer 10% POE peak (with a lag of two years), and minus 0.28 for the winter 10% POE peak. (The price elasticity shown here for customer sales is for combined residential and business sector sales. Our actual forecasting model treats each sector separately and identified a price elasticity of minus 0.31 for residential sales and minus 0.17 for business sales). The estimated income elasticity, which measures the relative change with respect to GSP, is 0.77 (with a lag of one year) for the summer peak, 0.98 for the winter peak, and 0.86 (with a lag of one year) for sales*."

The above quote shows that, for South Australia at least, the price elasticity of peak demand is of similar order of magnitude to the price elasticity of annual energy demand. In other words, a price increase is expected to have a material impact on maximum demand as well as energy.

While there are uncertainties related to the CPRS[36], MMA considers that its impact should be given some consideration in forecasting of maximum demand over the medium-term. At the very least it would be expected to have a negative impact in energy and maximum demand, although the extent may be unclear.

2.10 Impact of proposed network price increases

Within their regulatory proposals, Energex and Ergon Energy have both proposed very similar levels of revenue escalations through the X factors in a CPI-X tariff mechanism, Energex with X being -25.3% in 2010/11 followed by -8.4% thereafter[37] and Ergon Energy with X being -27.05 in 2010/11 followed by -7.69% thereafter[38]. This means substantial expected real distribution price increases in the first year and still material price increases thereafter.

34 Annual Planning Report, ESIPC, June 2008.
35 Amended by ESIPC from -0.21 to -0.28. See letter from ESIPC to S Edwell dated 31 October 2008.
36 Including the price and timing of introduction given the GFC, the price elasticity of maximum demand and the effect of substitute fuels such as gas also facing significant price increases.
37 Energex regulatory proposal ,page 265.
38 Ergon Energy regulatory proposal, page 30.

According to Energex, the result of its regulatory proposal would be to increase network prices from 4.2 to 5.37 c/kWh in 2010/11 and delivered prices to customers by 10% in 2010/11 and by 4% pa thereafter[39]. The expected delivered price outcome for Ergon Energy would be expected to be similar.

While the final price outcome is unclear, the expected delivered price increase would be additive to the CPRS increases discussed in Section 2.9 above and would be expected to also have an impact on both energy consumption and maximum demand. The proposal by the Queensland Competition Authority (QCA) to move towards cost reflective tariffs[40] may also result in further price increases.

2.11 Energy efficiency and other programs

Both households and the non-residential sector are expected to become more energy efficient over time due to a combination of, among others:

- attempts to reduce greenhouse gas emissions including the CPRS referred to in Section 2.9 above
- national reporting of greenhouse emissions by large commercial and industrial energy users from 1 July 2008
- minimum energy performance standards (MEPS) required on a range of appliances by the Federal Government
- the banning of incandescent lighting by 2010 announced by the Federal Government in 2007
- improved house construction techniques and requirements leading to lower energy usage
- the wide-spread expansion of household insulation as part of the Federal Government's stimulus package
- time of use tariffs which would tend to reduce usage during times of peak pricing.

While the impact of some of these measures on energy consumption can be estimated, it is much harder to assess the impact on maximum demand. To a certain extent the impact of such programs will be captured in any future trend analysis. However, this will take some time.

For the coming regulatory period, while it might be recognised that the combination of the measures and programs discussed above are likely to have some downward impact on maximum demand growth, the extent of the reduction is very difficult to quantify.

39 Energex regulatory proposal, page 24.

40 Queensland Competition Authority final report, "Review of electricity pricing and tariff structures – Stage 1", September 2009.

2.12 Summary of key driver changes

The period 2002 to 2008 saw significant increases in maximum demand on Queensland networks due to a combination of high economic growth, strong increases in air-conditioner penetration and power and high population growth.

Two of these key drivers are expected to undergo significant change over the period 2008 to 2015:

- state economic growth, which averaged 5% pa is forecast to reduce to less than 3% pa because of the GFC, some 50% to 60% of recent growth. This is expected to impact significantly on commercial and industrial growth and associated maximum demand
- air conditioning penetration, which grew at about 5 percentage points pa between 2002 and 2008 is approaching saturation and is expected to increase at less than 2 percentage points pa. While most new homes are expected to still be air conditioned, this means significantly less existing homes which will convert to air conditioning compared to the previous period, with resulting reductions in maximum demand growth. While the number of air-conditioners in houses and their power may continue to increase (although this may also be tempered by the economic downturn) there is no reason to believe that these increases will be greater than those seen in the 2002 to 2008 period.

Population and customer number growth are also expected to reduce a little in percentage terms – although to stay approximately constant in terms of new customer connections each year.

These very significant changes in key drivers, together with difficult to quantify impacts of price increases and energy efficiency programs due to efforts to reduce greenhouse gas emissions, means that maximum demand growth over the 2008 to 2015 period is expected to be less than it was over the 2002 to 2008 period. As a result, a simple extrapolation of growth from the current period is expected to provide an unrealistic expectation of maximum demand changes over the period to 2015.

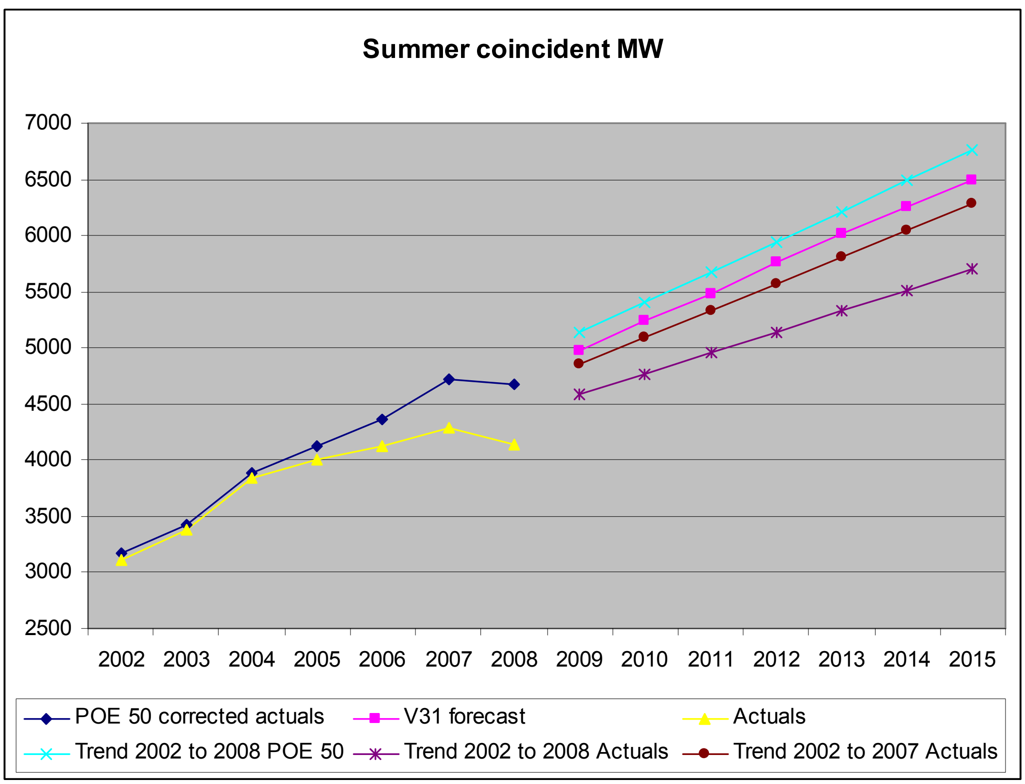
The mild weather experienced in 2008 and lack of very hot days in 2008 and 2009 also serve to stress the importance of proper weather correction in forecasting.

3 ENERGEX FORECASTS AND FORECASTING APPROACH AND METHODOLOGY

3.1 History and Energex projections of network summer maximum demand

The recent history of Energex's network summer coincident maximum demand between 2002 and 2008 is shown in Figure 3-1 together with the growth projected by Energex in its V31 forecasts[41] over the period to 2015. Two historical sequences are shown, actual recorded MDs and a "POE 50%" series as weather corrected by Energex. The Energex POE 50% values over the period are all higher than the actuals, particularly so after 2004. This appears anomalous as, while 2007/08 was considered to be a particularly mild year in south east Queensland, some of the years within that period were considered hotter than normal[42]. Further analysis of weather normalisation is presented in section 4.2.

Figure 3-1 Energex's network summer coincident maximum demand history and forecast and trendline projections, MW



Source: Energex, RSD 2.3.8(1) Demand Forecast and information provided, MMA analysis.

41 From the Version 31 model provided in the RIN.

42 For example, according to page 26 of the Powerlink APR 2009 2004 was hot and humid and the years 2003 and 2004 both had 3 days or more exceeding the POE 50 temperature.

Also, included in the figure are three linear trendline projections and the Energex V31 projection used as the basis for the detailed capex calculations in the regulatory proposal. The top projection line is the trendline based on Energex's 2002 to 2008 POE 50% corrected data. Next on the graph is the Energex V31 projection, starting at 4,975 MW in 2009 and reaching 6,490 by 2015. Below this is a projection based on the 2002 to 2007 actuals history (excluding the mild 2008 summer) and then a projection based on the 2002 to 2008 actuals.

As can be seen, even if all drivers were the same as those experienced over the past five or six years, the range of outcomes could differ substantially, ranging from 5,700 MW to almost 6,800 MW by 2015. Annual growth from these projections also differs substantially, from 185 MW to 270 MW pa. In its V31 forecast, Energex has projected average annual growth of about 250 MW pa.

Thus, there are two key considerations in assessing the Energex V31 forecasts at a system level. The first is what would have been an appropriate starting point and trend to use in the absence of any significant change to key drivers. The second is whether the key drivers of maximum demand have changed significantly, or are likely to do so over the coming period, and if so, the likely impacts.

Section 4.2 discusses the first question. The previous Chapter assessed the key drivers which are likely to impact on maximum demand over the coming period, and how these differ from the previous period while Chapter 4 considers the likely impact.

3.2 Forecasts relied upon by Energex

Energex initially based its capital expenditure forecasts on its V31 demand forecasts prepared in 2008. However, Energex recognised that the key drivers had changed, in particular the advent of the GFC, which became apparent towards the end of 2008 and the CPRS.

As a result, Energex has continued to use the V31 forecasts as the basis of its capex forecasts, but has then adjusted them at a system level to take account of the changed key drivers and the impact of some demand management initiatives.

According to Chapter 10 of the Energex Regulatory Proposal

"*The baseline forecasts used in the preparation of forecast capital and operating expenditures and included in this Regulatory Proposal were developed as part of ENERGEX's annual planning processes, prior to an understanding of the wide-reaching impact of the GFC and the Federal government's CPRS. However, ENERGEX continues to monitor the impact of these issues on its forecasts and resulting expenditure programs.*

ENERGEX's approach in this Regulatory Proposal is to set the 2008 forecasts as a baseline and adjust the demand forecast for the GFC impacts as well as DM initiatives. A full review of all *forecasts will be conducted during 2009 as part of ENERGEX's annual planning and reporting processes."*[43]

MMA has reviewed the V31 forecasts and forecast methodology but has then also assessed the NIEIR April 2009 system demand forecasts according to which Energex has amended its forecast capex.

3.3 Overview of Energex V31 approach

Energex takes a combined approach, both bottom up (spatial) and top down (system) to maximum demand forecasting. The bottom up outcome is derived by forecasting the underlying growth at zone substation (ZSS) level and accounting for block loads and load transfers. The top down is a system forecast for Energex's region that is based on econometric forecasts, primarily GSP but also taking into account air-conditioner growth, and temperature.

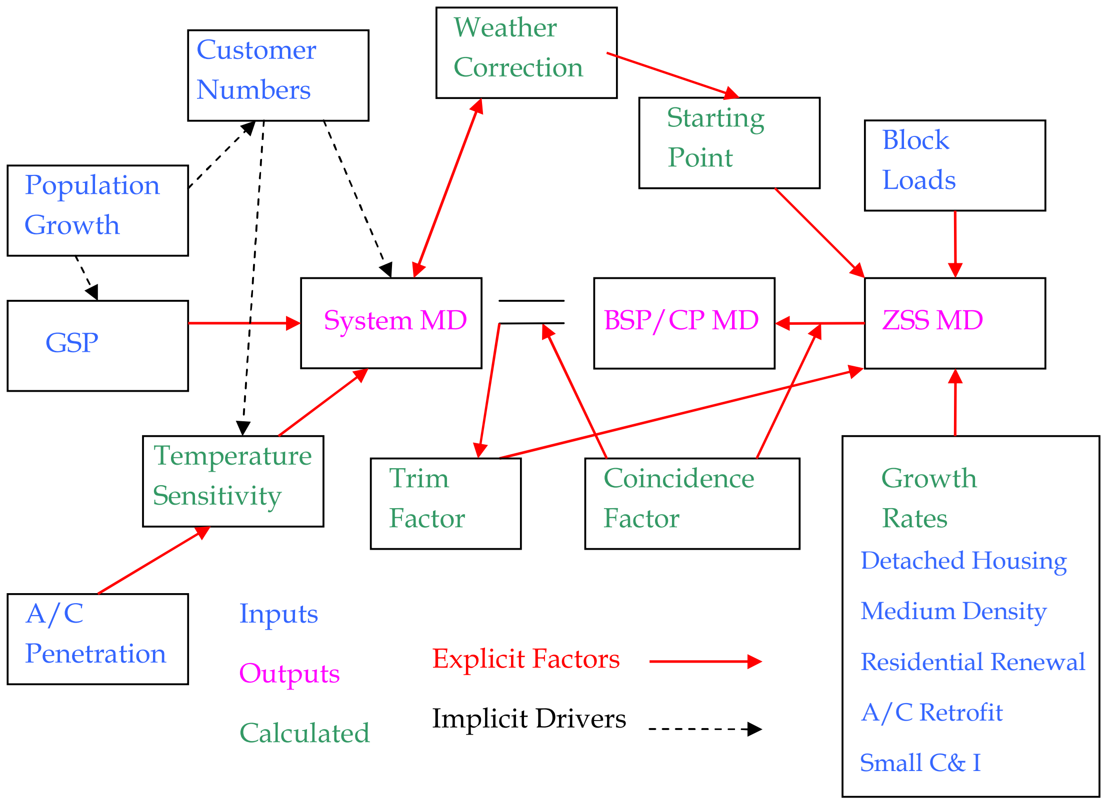
Energex considers the top down forecast more reliable. Its reasoning is that the region as a whole is more predictable than the individual ZSS areas. For example, the overall population or dwelling growth for Brisbane can be more accurately forecast in percentage terms than can the growth of individual suburbs.

When the spatial and system forecasts are reconciled, the spatial forecasts are adjusted to match the system through using a "Trim Factor".

Figure 3-2 shows the relationships between the various inputs and outputs used by Energex.

43 Energex Regulatory Proposal , page 137.

Figure 3-2 Diagram of Inputs, Outputs and Relationships



Energex prepared its V31 forecasts after the summer of 2008. As most of the ZSS capex requirements are assessed at the 50% POE level (typically on an N-1 capacity basis to allow an acceptable level of security), this is the forecast we have focused on. We comment briefly on the POE 10 methodology in Section 5.7.

3.3.1 System level forecasts

Energex has used a model initially developed by ACIL Tasman as the basis for its POE 50% and POE 10% system forecasts. The parameters in the version of the model used for the forecasts (Version 31) were re-estimated by Energex. The model comprises the following steps:

1. Derivation of a model relating summer daily maximum demand (the maximum half-hour demand on each day), to key drivers over a number of summer periods, using standard multiple linear regression techniques. The drivers used in version 31 were Queensland GSP and maximum and minimum daily temperatures. This model yields fixed coefficients for each of the three variables – in subsequent discussion we refer to it as the Fixed Coefficient model. Version 31 of this model was derived using data covering the period 2001/02 to 2007/08.

2. The maximum and minimum daily temperature model parameters were then re-estimated using the annual data for each year from 2001/02 to 2007/08, excluding the GSP variable, to estimate the maximum and minimum temperature coefficients for each year. In general, these coefficients increase from year to year owing to the increasing temperature sensitivity of the load, in contrast to the Fixed Coefficient model, in which the coefficients are the same each year. Increases in the average value of the coefficients were then related to increases in number of air-conditioners per household, in order to derive projections of the temperature coefficients for the forecast period based on projected increases in air-conditioner penetration.

3. The forecast model was assembled using the GSP and constant coefficients from step 1 and the growth in temperature coefficients from step 2. GSP forecasts prepared by NIEIR and air-conditioner penetration forecasts derived by ACIL Tasman from work done by EES were used as inputs.

4. To obtain estimates of the POE 50% and POE 10% maximum demand in each year, model values corresponding to a representative distribution of maximum and minimum temperatures were calculated based on actual values of maximum and minimum temperatures each day in the summers from 1955 to 2007. The POE 50% and POE 10% values of the resulting distributions of maximum demand in each year comprise the forecast.

3.3.2 Spatial level

In overview, Energex forecasts each ZSS on a bottom up basis using four key steps.

1. Starting Point at each ZSS is calculated, based on weather correcting to 50% POE.

2. Forecast growth at each ZSS is based on subjective judgements in a number of growth categories.

3. Addition of block loads above a threshold size.

4. Future planned transfers are taken into account.

3.3.3 Reconciliation of spatial and system maximum demands

The sum of ZSS growth multiplied by coincidence factors is then reconciled to the coincident system demand by multiplying each ZSS by a “Trim Factor” which changes on an annual basis.

3.4 Preliminary review of forecasting approach and methodology

In its preliminary review MMA evaluated the Energex approach and overview methodology against criteria relate to both key drivers of growth and the forecasting process itself.

3.4.1 Approach

MMA considered the overall Energex approach to be good maximum demand forecasting practice[44]. Under this approach Energex undertook:

- bottom up forecasting at the spatial level
- top down forecasting at the system level taking into account key drivers
- reconciliation of the spatial forecast to the system demand forecast through a "Trim Factor".

3.4.2 System maximum demand

While MMA generally considered the use of a multi linear regression model to be good practice, it had some concerns about the actual model parameters used. MMA considered that incorporation of two key drivers of maximum demand, GSP and air-conditioner penetration, in the system maximum demand model should ensure that the model is capable of providing reasonable and realistic forecasts. MMA considered that the derivation of the Fixed Coefficient model by regression methods in step 1 of the process was reasonable but that the addition of temperature coefficient growth in step 2 had not been validated, ie the accuracy of the complete model in predicting the data had not been tested. MMA was concerned that each growth component would by itself explain the total MD growth and that adding them together would in effect be double counting. MMA presented a number of approaches that could be used to validate the complete Version 31 model.

MMA also had a number of other, possibly less material, concerns regarding the modelling and choice of variables:

1. The temperature variables should be replaced by Average Temperature or Weighted Average Temperature to avoid the problems caused by different growth patterns in the Max and Min coefficients. This would also facilitate inclusion of multiplicative variables directly in the regression.
2. The air-conditioner penetration variable should be replaced by the absolute number of air-conditioners (penetration x number of customers) or an equivalent index, to account for growth in air-conditioners even when the penetration is constant.
3. In the sample years used to establish the 50% POE and 10% POE levels of demand, only the days used to derive the model should be included, ie weekends, public holidays and other days excluded from model derivation because annual peaks never occur on those days, should be excluded.

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[44] [44] MMA defines good maximum demand forecasting practice (referred to as good practice in this report) as an approach, methodology and the application of methodology which results in realistic and reasonable maximum demand forecasts. The criteria according to which good forecasting is assessed are based on MMA's experience in reviewing, for regulators and others, a number of demand forecasts made by electricity and other utilities and also draws on work and publications by H Lee Willis, in particular H Lee Willis, "Spatial electric load forecasting", Second edition,Marcel Dekker Inc, New York, 2002.

4. In the longer-term the model should be replaced by one that can replicate the occurrence of peak demands on Saturdays, ie using suitable dummy variables.
5. The forecast should be based on an updated GSP forecast which takes into account the likely effects of the Global Financial Crisis and the expected introduction of the CPRS.

3.4.3 Spatial maximum demand

Although MMA generally considered the approach and methodology used at the spatial level to be reasonable, it had some concerns about potential for inappropriate judgements in the areas of:

- temperature correction to establish starting points
- basing growth at ZSS level purely on factors derived subjectively
- the timing and size of block loads.

3.4.4 Reconciliation of system and spatial maximum demand

MMA considered it good practice for the spatial forecasts to be ultimately reconciled to the system level forecasts by using a Trim Factor.

However, MMA was concerned that the system maximum demand should be appropriately derived (see Section 3.4.2) and also that recent changes to key drivers, including the impacts of the GFC and the CPRS should be taken into account.

3.4.5 Energex comments on and responses to MMA's preliminary review

In two documents[45] Energex has provided responses to MMA's preliminary review, including:

- In response to MMA concerns about the validation of the Version 31 model, Energex provided evidence that other models, derived using the approaches suggested in the preliminary review, were less satisfactory than the Version 31 model. MMA accepts this evidence about the other models but does not consider that this validates the Version 31 model.

  Moreover in another document[46] it is claimed that the Version 31 forecasting model's pattern of residuals appear to be random. However the residuals presented are clearly those of the Fixed Coefficient model (they match the residuals presented in MMA4b sheet "ACIL's model ACIL's data" which derives the Fixed Coefficient model) and not the Version 31 forecasting model, so this too is inconclusive regarding the Version 31 model's validity.

- In response to point 1 in section 3.4.2 above Energex responded that it had "re-examined the impact of the minimum and maximum temperature coefficients and have maintained a constant minimum temperature coefficient and only escalated

[45] MMA 2 "Review of MMA's suggested forecasting approaches" and MMA 2 "Response".

[46] MMA4a"Peak Demand Forecast Energex system level forecasting methodology for 2007/08".

the maximum temperature coefficient in the multiple regression model used to develop the new forecast". It is difficult to understand what this new forecast means however, as in the Version 31 model both coefficients are escalated.

- In response to point 2 in section 3.4.2 Energex responded that "the number of air-conditioners per house is the basis for the models – not the percentage of households with air conditioning". However, the thrust of point 2 is that MD growth is more likely to be driven by the total number of air-conditioners than the number per house and unfortunately Energex response does not address this.
- Points 3, 4 and 5 in section 3.4.2 above were accepted by Energex.

3.5 Estimating the impact of the GFC

In addition, as mentioned in Section 3.2, Energex recognised that its capex forecasts needed to take into account changes to key drivers, primarily the GFC.

Although it did not have time to do this in detail, Energex made a preliminary assessment of the impacts of the changes to key drivers, and amended its forecasts by:

- asking NIEIR to prepare up-to-date system maximum demand forecasts. The NIEIR April 2009 forecasts took into account the GFC impact.
- subtracting the NIEIR April 2009 forecasts from the baseline V31 forecasts Energex had previously prepared
- subtracting a further amount for demand management programs
- reducing the demand driven component of the capital expenditure program by an amount that is proportional to the anticipated demand reduction arising from these factors.

The Energex explanation and amendments are described in Chapter 11 of its Regulatory Proposal.

Energex's resulting preliminary assessment of forecast system maximum demand after taking into account the changes to key drivers is provided in Table 3-1. We have inserted the earlier years of the forecasts and also, for the sake of comparison, the NIEIR forecasts for the Energex region carried out in October 2008[47].

The NIEIR October 2008, Energex V31 and NIEIR April 2009 system maximum demand forecasts are illustrated in Figure 3-3. Energex's baseline V31 peak demand forecast is similar to the October 2008 NIEIR peak demand, starting a little lower in 2009 but averaging about 90 MW higher over the latter years of the period.

[47] NIEIR report to Energex, "Electricity consumption and maximum demand projections for the ENERGEX region to 2018" October 2008.

Table 3-1 Amendments made by Energex to system maximum demand forecasts, MW

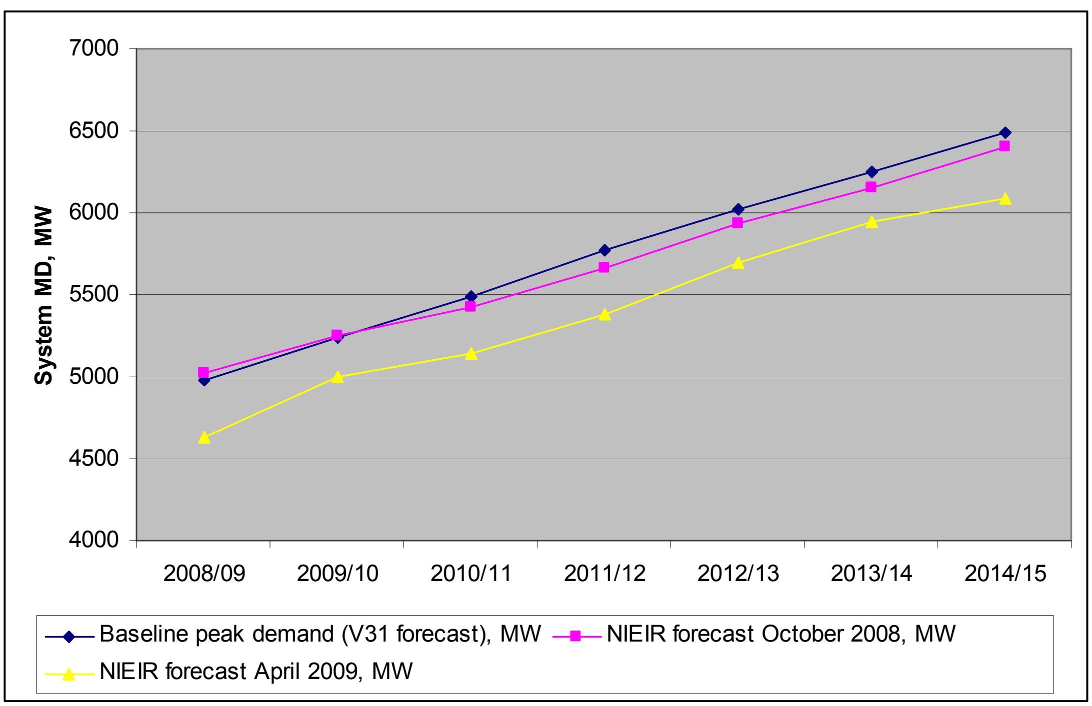
	2009	2010	2011	2012	2013	2014	2015
NIEIR forecast October 2008	5,021	5,249	5,423	5,664	5,930	6,156	6,404
Baseline peak demand (V31 forecast)	4,975	5,243	5,486	5,767	6,023	6,250	6,490
NIEIR forecast April 2009, MW	4,635*	4,997	5,144	5,378	5,699	5,945	6,085
Demand management initiatives			-18	-40	-67	-101	-144
Adjusted peak demand forecast		4,997	5,126	5,338	5,632	5,844	5,941
Net reduction in forecast demand			360	429	391	406	549

Source: Energex Regulatory Proposal Table 11.2, NIEIR October 2008 and April 2009 forecasts, * We understand this is an actual for native Maximum Demand, rather than POE 50% forecast. Energex has given the 2009 actual as 4593[48].

The NIEIR April 2009 forecast is, on average over the period 2010 to 2015, some 5.7% or 335 MW lower than the Energex baseline V31 forecast. Because of the impact of the GFC, the NIEIR April 2009 forecasts start some 5% lower than the V31 forecasts, and remain some 6% lower over the coming regulatory period.

The NIEIR April 2009 forecast is, over the period 2010 to 2015, some 260 MW or 4.5% lower than the NIEIR October 2008 forecast. However, the difference is greatest in the early years, reduces in the years 2013 and 2014 before extending again in 2015.

Figure 3-3 System maximum demand forecasts by NIEIR in October 2008 and April 2009 and the Energex V31 baseline forecast



48 Energex Regulatory Proposal, page 82.

3.6 Forecasts reviewed by MMA

Energex has relied upon its V31 baseline forecasts in establishing its baseline capex program but has then adjusted the capex program after taking into account the NIEIR April 2009 system maximum demand forecasts.

MMA has primarily reviewed the baseline V31 forecasts, but has also taken into account the NIEIR April 2009 GSP forecasts and system maximum demand forecasts in its review.

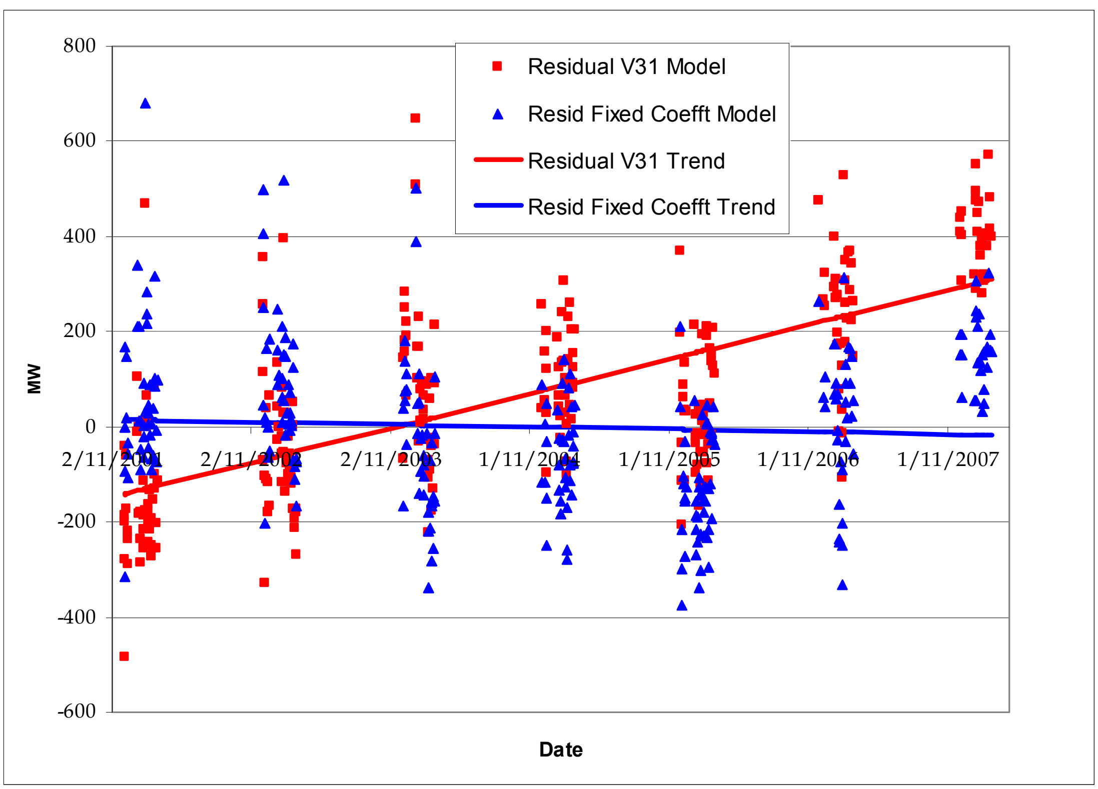
4 SYSTEM MAXIMUM DEMAND

4.1 Methodology

Information provided by Energex has been used to test the validity of the Energex V31 model, in light of MMA's preliminary review finding that neither ACIL Tasman nor Energex had provided adequate model validation (section 3.3.1). Our major concern with the Energex V31 methodology was that it may double count the MD growth due to GSP growth, reflected in the GSP Coefficient in the model, and MD growth due to air-conditioner penetration, reflected in growth in temperature sensitivity coefficients. Our concern is due to the fact that the growth in temperature sensitivity coefficients was derived independently of the GSP coefficient, which was determined in a regression analysis involving fixed temperature coefficients (the Fixed Coefficient Model), which by itself fully accounted for MD growth over the historical period.

We have used the V31 model parameters provided by Energex and historical temperature and GSP data to reconstruct the model residuals (the difference between model predictions and actual peak demand on each day of the historical period). These are plotted in Figure 4-1 together with the residuals for the Fixed Coefficient Model derived in step 1 of the ACIL Tasman/Energex modelling process.

Figure 4-1 System MD model residuals



It is clear from this analysis that the Version 31 model predictions are biased downwards in early years and biased upwards in later years, resulting in a strong time trend in the residuals and confirming MMA's concerns that the model would double count GSP and temperature sensitivity growth. Predicted demands in 2008 are biased upwards by approximately 300 MW. A model displaying this level of bias is not considered to be a suitable basis for MD forecasting.

In contrast, the Fixed Coefficient Model predictions show very little bias, as we would expect because it was derived in a single stage regression analysis.

It is also clear from Figure 4-1 that the Version 31 model is a less accurate predictor than the Fixed Coefficient model and this is reflected in their respective standard errors of 217 MW (Version 31) and 164 MW (Fixed Coefficient). On this measure alone the Fixed Coefficient model would be preferred to the Version 31 model.

4.2 Review of Historical 50% POE MDs

Before considering alternatives to the Version 31 model, it is instructive to review estimates of historical 50% POE MDs, particularly as it was noted in section 3.1 that the Energex POE 50% values appear anomalous as they are all higher than actuals.

Figure 4-2 illustrates a range of different estimates of historical 50% POE MDs, alongside actual MDs:

- Energex RSD estimates (sourced from Table 1.4 in RSD 2.3.8, methodology unknown)
- Energex estimates based on the Version 31 model (sourced from Energex Forecasting macros for V31)
- Estimates based on Energex annual regressions using maximum and minimum temperatures (sourced by inserting the relevant temperature coefficients in the Energex Forecasting macros to calculate 50% POE MDs. The 2009 value was estimated by MMA using Energex data)
- Powerlink estimates (sourced from Table B.3 in Powerlink's Annual Planning Report 2009)
- MMA estimates based on annual regressions using a weighted average temperature (70% maximum + 30% minimum).

Figure 4-2 Estimates of historical 50%POE MDs

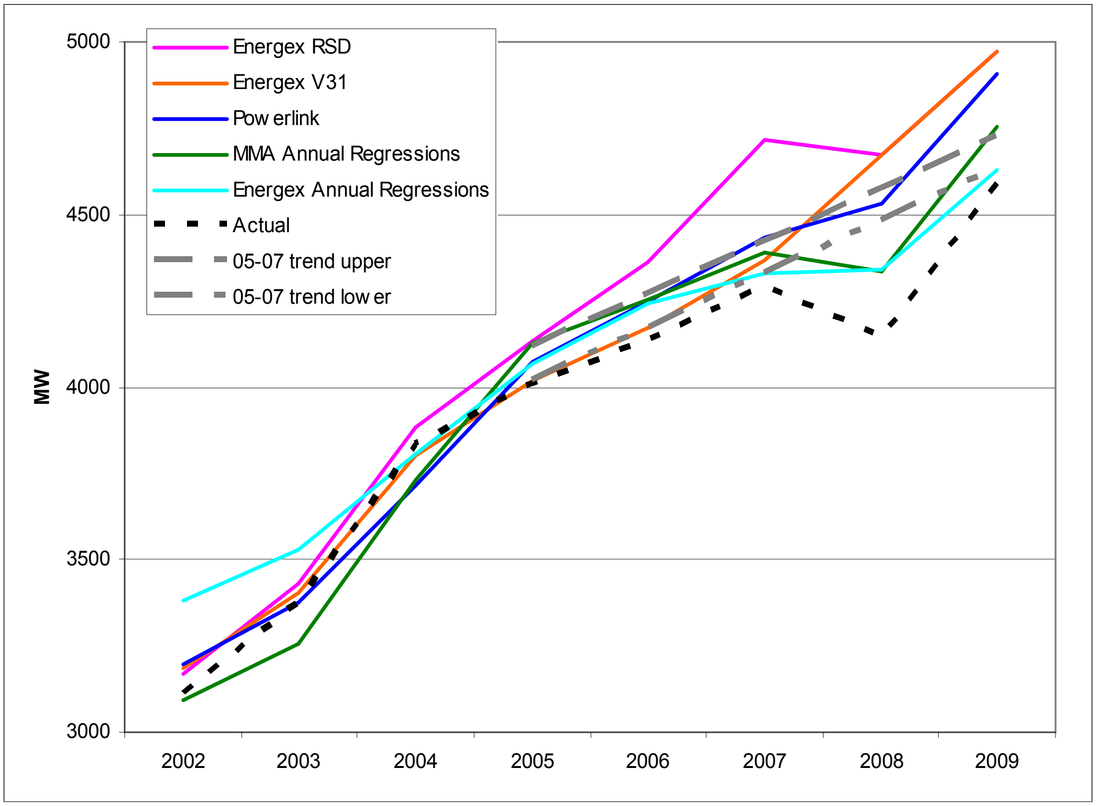


Figure 4-2 shows that the different approaches yield different 50% POE MD estimates, particularly for 2008 and 2009, which were characterised by generally milder summer weather. This makes it difficult to determine the most appropriate estimates for this period, which unfortunately is the most critical for the forecast period.

To assist with determining the 2008 and 2009 values, upper and lower trends (excluding the Energex RSD values, which appear anomalous) have been projected from the apparently more reliable 2005-2007 period. The trends suggest that the 2009 50% POE MD should be in the range 4636 MW to 4729 MW, which is consistent with the values produced by the annual regression methods (4632 MW for Energex's and 4756 MW for MMA's). This range is considerably lower than the 4,975 MW projected by the Version 31 model, however this is to be expected given the inherent 300 MW upward biases in the latter. The Powerlink estimate suggests a value of approximately 4900 MW but we note that Figure B.1 in Powerlink's 2009 APR suggests that native peak demand at the 50% POE reference temperature would be approximately 4,750 MW. We therefore believe that the 2009 50%POE MD most probably lies in the range 4,600 MW to 4,750 MW and that a value outside this range is improbable.

4.3 Alternative models

We have considered four alternatives to the Version 31 model, each of which allows for growth in temperature sensitivity and base load to contribute to MD growth.

- Revised V31 Model A (Model A). To derive this model we have taken the historical temperature coefficients from the V31 model, subtracted their contribution from actual daily peaks and regressed the remainder against GSP, using the data used to derive the V31 model. The model then comprises the temperature coefficients from V31 and the new GSP coefficient and constant. This approach avoids double counting MD growth due to GSP and air conditioning and results in a GSP coefficient of 0.0371 compared to 0.0698 in the V31 model (this approach was not contemplated in the preliminary review but is a suitable alternative to the methods suggested there).
- Revised V31 Model B (Model B). For this model we have re-derived the temperature coefficients using an index of air-conditioner numbers (air-conditioners per household times the number of residential customers) instead of air-conditioners per household, to address this issue which was raised in the preliminary review. The estimation of the GSP coefficient was undertaken as for Model A. The temperature coefficients for this model are presented in Table 4-1.
- Model C. A Time-based model with three variables: time; weighted average temperature; and time * weighted average temperature. The last factor accounts for growth in temperature sensitivity. The coefficients were derived directly by regression analysis.
- Model D. A GSP and air-conditioner (A/C) based model with three variables: GSP; weighted average temperature; and weighted average temperature * air-conditioner. The last factor accounts for growth in temperature sensitivity. The coefficients were derived directly by regression analysis.

All models were estimated using data for the period 2001/02 to 2007/08.

Table 4-1 Estimated coefficients for Models A and B

	Max Temp	Min Temp	GSP	Constant
Model A				
2008	83.0	40.8	0.0371	-1602
2009	84.2	41.4	0.0371	-1602
2010	85.4	42.0	0.0371	-1602
2011	86.7	42.6	0.0371	-1602
2012	87.9	43.2	0.0371	-1602
2013	89.2	43.8	0.0371	-1602
2014	90.4	44.5	0.0371	-1602
2015	91.8	45.1	0.0371	-1602

	Max Temp	Min Temp	GSP	Constant
Model B				
2008	84.8	41.7	0.0331	-1438
2009	87.1	42.8	0.0331	-1438
2010	89.5	44.0	0.0331	-1438
2011	92.0	45.2	0.0331	-1438
2012	94.7	46.5	0.0331	-1438
2013	97.6	48.0	0.0331	-1438
2014	100.7	49.5	0.0331	-1438
2015	104.2	51.2	0.0331	-1438

Table 4-2 shows the R-squared and standard error statistics for the four models where applicable and compares them to the Fixed Coefficient Model. In terms of these statistics all four models are improvements on the Fixed Coefficient model. The model with the lowest standard error and the highest R Sq is the Time-based model, however in terms of 50% POE estimates this simply produces a straight-line trend (Figure 4-3) and is clearly inappropriate for forecasting purposes.

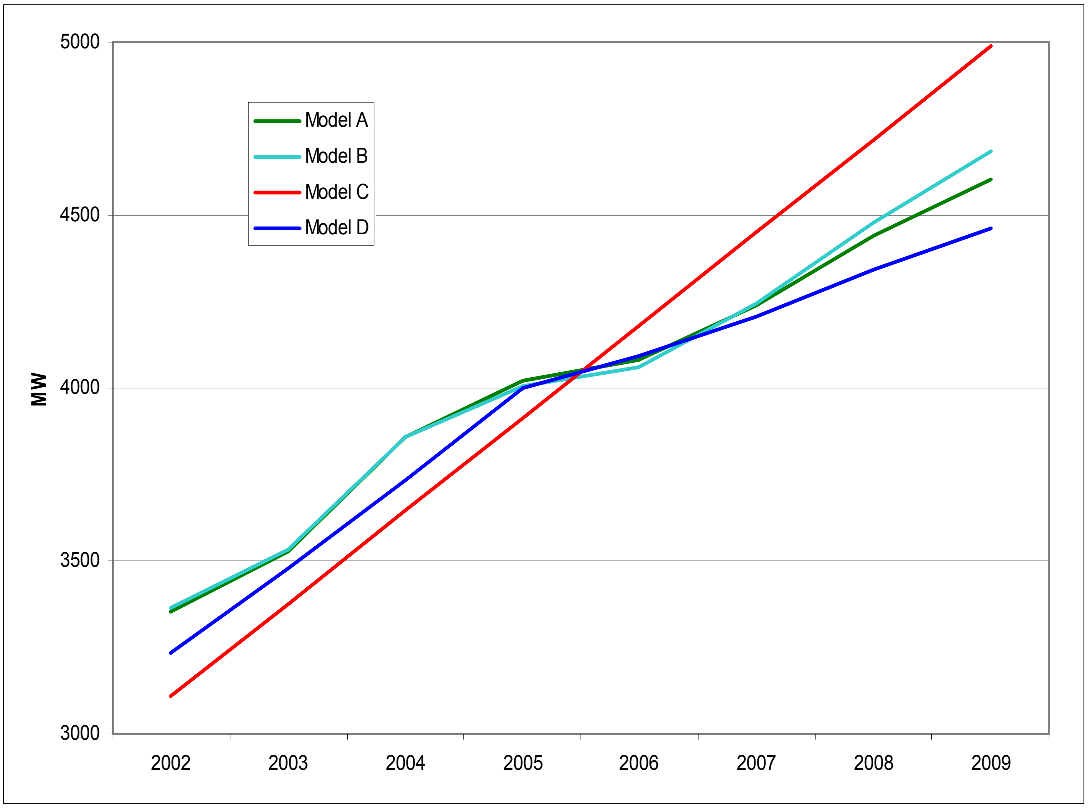
Models A, B and D produce qualitatively similar 50% POE estimates, all three indicating that the trend in growth changed in 2006. However, Models A and B yield estimates of the 2009 50% POE MD that are within the estimated range of 4,600 MW to 4,750 MW whereas Model D does not, consequently, we have a slight preference for Models A and B, the revised V31 models. On the basis of their accuracy there is very little to choose between Model A and Model B.

Table 4-2 Alternative model statistics

Model	R Sq	Std Err (MW)
Fixed Coefficient	0.83	164
Model A	Not comparable[49]	145
Model B	Not comparable	148
Model C	0.90	128
Model D	0.89	136

[49] Owing to the model being regressed on remainders rather than the original demand data.

Figure 4-3 Alternative model estimates of historical 50% POE MDs



4.3.1 Projections

The 50% POE System MD projections produced using the Version 31 model and Models A and B, using Energex GSP forecasts (September 2008, pre GFC), are presented in Table 4-3. The Version 31 model projections are as reported by Energex, except for 2011 which is 17 MW higher than Energex[50]. Model A starts off 300 MW lower than V31 and grows considerably more slowly owing to the lower GSP coefficient, ending up 950 MW lower in 2015. Model B starts off 250 MW lower than V31 and grows more quickly than Model A because the lower GSP coefficient is partly offset by additional growth in the temperature sensitivity coefficients, because these include residential customer growth. Model B is 456 MW lower than V31 in 2015. MMA does not believe that Model A adequately captures MD growth and Model B is therefore our preferred forecasting model.

50 The Energex V31 Forecasting spreadsheet appearsa to contian some minor errors and we believe the 2011 figure is incorrectly calculated.

Table 4-3 Pre-GFC 50% POE System MD projections (MW)

	V31 model	Model A	Model B
2008	4,673	4,374	4,422
2009	4,975	4,562	4,650
2010	5,243	4,732	4,867
2011	5,503	4,899	5,086
2012	5,767	5,068	5,313
2013	6,023	5,233	5,548
2014	6,250	5,383	5,782
2015	6,490	5,541	6,034

The 50% POE System MD projections produced using the Version 31 model and Model B, using NIEIR GSP forecasts (April 2009, post-GFC), are presented in Table 4-4 and compared with the April 2009 NIEIR forecast (the Version 31 model projections are MMA estimates). Owing to its lower GSP coefficients the impact of the lower GSP forecast on Model B projections is less than on the Version 31 model. Compared to the pre-GFC forecasts, the 2015 MD estimate is reduced by 435 MW in Version 31 and 206 MW in Model C. Consequently the difference between Version 31 and Models B in 2015 is reduced to approximately 220 MW.

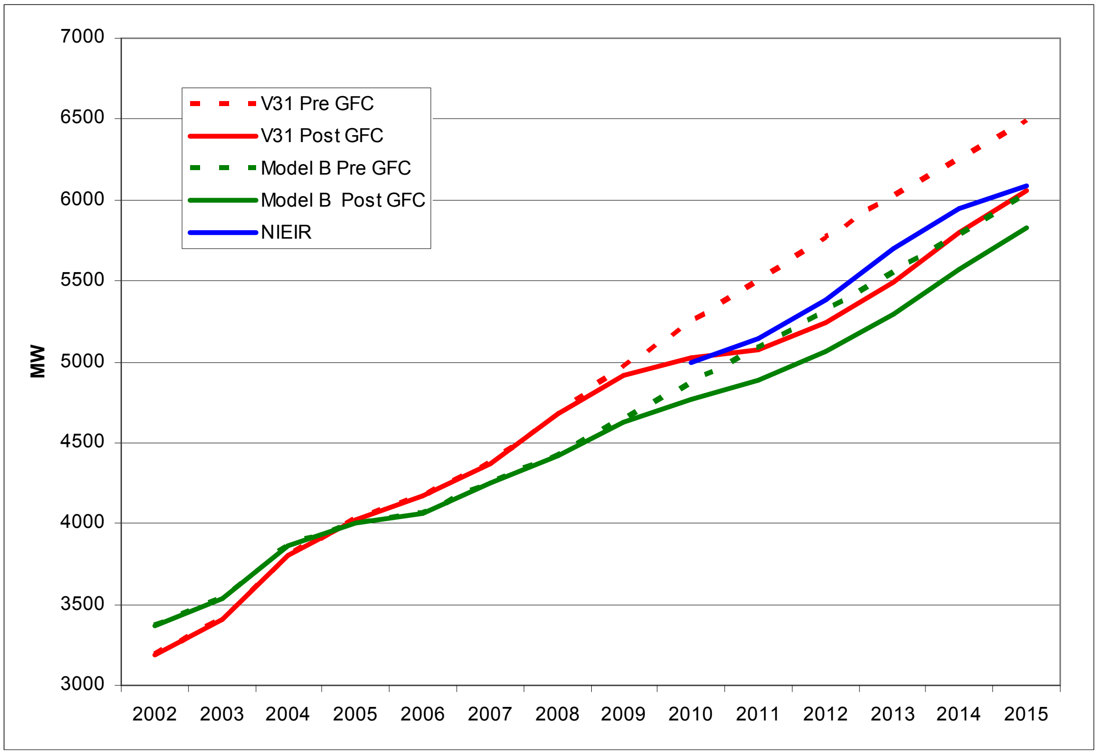
In this GSP scenario the growth from 2008 to 2015 is very similar in the two models and the difference in levels in 2015 relates directly to the differences in 2008 and 2009, as shown in Figure 4-4. The differences between the MMA estimates and NIEIR estimates can also largely be ascribed to differences in the initial estimates rather than differences in growth. Based on these similarities in growth, we would view any projection with similar growth and starting from a 2009 value in the range 4,600 MW to 4,750 MW (refer to section 4.2) to be reasonable. The range in values each year would be Model B -24 MW to Model B +126 MW. The NIEIR and V31 Model projections lie above the upper envelope of this range and we therefore do not consider them to be reasonable.

Table 4-4 Post-GFC 50% POE System MD projections (MW)

	V31 model	Model B	NIEIR
2008	4,673	4,422	4,114*
2009	4,920	4,624	4,635*
2010	5,021	4,762	4,997
2011	5,073	4,882	5,144
2012	5,248	5,067	5,378
2013	5,489	5,295	5,699
2014	5,797	5,567	5,945
2015	6,055	5,828	6,085

* Understood to be actual rather than weather corrected values.

Figure 4-4 Comparisons of 50% POE historical estimates and projections using different models



Over the period 2011 to 2015, there is a significant difference between MMA's preferred model, Model B, and April 2009 NIEIR model. The outcomes from using Model B model are some 6% lower than the April 2009 NIEIR forecasts. Using the upper envelope of the "reasonable" projections, this difference would be reduced to 3.5%.

4.4 Demand management strategy

From 1 July 2009 under the Electricity Amendment Regulation, Energex is required to submit to the Queensland jurisdictional regulator for approval a demand management (DM) plan which includes performance targets for each DM initiative[51]. According to Energex it has been steadily building its demand management capability for the past 3 years[52].

Energex has listed a number of programs which it has already undertaken including:

- direct load control trials through the "Cool Change" program

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51 Energex, Regulatory Proposal, page 78.

52 Energex, Regulatory Proposal Appendix 5.1 "Energex Demand Management Strategy 2010 to 2015" updated 29 June 2009, page 1.

- a "Summer Preparedness" program whereby larger customers who could shift load or have standby generation will provide network support.

In the forthcoming regulatory period Energex proposes a three part strategy:

- a demand Management Incentive Scheme
- broad based demand management that also result in reduced consumption
- network support agreements with customers.

Energex has stated that its DM program is not currently targeted at any specific geographical area and it has identified savings of 144 MW by 2015 (averaging 29 MW pa)[53] across the network as a whole.

Although Energex has quantified the expected savings of the DM program as a whole it has not done so on a program basis within the Regulatory Proposal. Given the relatively minor impact of the DM program expected by Energex, MMA considers it relatively immaterial compared to the other issues considered. MMA considers it reasonable to apply the DM impacts through a Trim Factor as it has other system maximum demand drivers.

4.5 Summary of the review of system maximum demand

MMA has found that:

- Energex's Version 31 forecast model displays bias and is less accurate than other model options MMA considers reasonable. MMA therefore does not consider it suitable for forecasting 50% POE MD.
- Mild weather during the 2007/08 and 2008/09 summers has increased the level of uncertainty in weather normalisation. MMA has estimated that the weather normalised 50% POE MD for 2008/09 lies in the range 4,600 MW to 4,750MW.
- A version of the Energex model that has been re-estimated to eliminate the bias and improve accuracy yields 50% POE MD projections that are approximately 6% lower than NIEIR April 2009 projections.
- From these should be subtracted additional savings from the DM program which are estimated by Energex to result in a further reduction in system MD of 144 MW by 2015.

[53] Energex, Regulatory Proposal, page 86.

5 SPATIAL MAXIMUM DEMAND

In this Chapter MMA reviews the methodology and forecasts developed by Energex at ZSS level to estimate the capex requirements for the Regulatory Proposal.

5.1 Spatial forecast methodology

The spatial forecast methodology used by Energex in its V31 forecasts at ZSS level has been described in overview in Section 3.3. It essentially consists of five key steps:

1. Determining the Starting Point. Energex starts with the most recent validated maximum demand reading and adjusts this starting point to a 50% POE level by using the ZSS weather versus MD correlation data from the most recent year and a total MW adjustment based on the 50% POE adjustment at the system level. Judgement is used to determine the 50% POE adjustment factor which is actually applied.

2. Growth. Energex then grows loads in each ZSS according to a judgemental method based on standard weighted growth categories for the following ten years, determined at a meeting with asset managers.

3. Block loads. Block loads which are above the threshold size level of 5% of ZSS MD are then added in the year in which they are expected to eventuate or, if tentative, over two years.

4. Transfers. Future planned transfers are included, subtracting load from one ZSS and adding it to another.

5. Reconciliation to system MD. The sum of forecast ZSS demand multiplied by coincidence factors is then reconciled to the coincident system demand by multiplying each ZSS by a "trim factor" which changes on a seasonal basis.

The methodology is described in detail in Appendix A. We review each key step in the remainder of this chapter based on the review carried out at selected ZSS. We note that we have reviewed a large number of other steps, for example, power factor calculations and conversions and capacitor compensation but these are not specifically commented on as we either have no issues with the methodology or the issues are immaterial.

5.2 Selected ZSS

Energex provided historical and forecast information for the Grovely and Mango Hill ZSS to illustrate its forecasting methodologies during the preliminary review. For the current review a further four ZSS:

- Alexandra Headlands (AHD)
- West Maroochydore (WMD)

- Arundel (ARL)
- Southport (SPO).

were selected for detailed review according to the process described in Section 1.3.2.

The Alexandra Headlands and West Maroochydore ZSS in the Sunshine Coast region are expected to contribute load to the proposed 2X60MVA, 132/11 kV substation at Maroochydore when it is commissioned in 2013/14.

The Arundel and Southport ZSS serve customers In the Gold Coast region and are expected to contribute load to the proposed 33/11 kV zone substation at Parkwood, in around 2011.

5.3 Starting point

Energex has attempted to apply a weather correction for the 2007/08 year as a starting point. Although the main body of the ACIL Tasman "Forecasting Maximum Demand" report[54] referred to three possible methods for doing so, Energex has chosen to use a fourth method outlined in Appendix B of that report.

While we consider that some form of weather correction is necessary for ZSS starting years, we are concerned that the method actually used has been described by ACIL Tasman, at the Bulk Supply Point level thus:

"At the Bulk Supply level, variations in daily demand that are non temperature related are relatively common. Any attempt to model these variations as a function of weather will tend to perform poorly. Estimated models will be mis-specified and subject to bias. The exception to this case is when there are no transfers or if these are very small in terms of magnitude. In this case, the majority of the variation will be temperature dependent and a good model fit will be obtained"[55].

As ACIL Tasman describes, the effect of block loads, transfers and temporary network states on calibrating temperature effects at even bulk supply point level are substantial. We would expect that this difficulties presented would be even greater at the ZSS level, at least until the effect of load transfers and block loads can be backed out.

ACIL Tasman's concern with the methodology is related primarily to the calculation of "Maximum temperature coefficient" (MTC), that is the demand response of each substation to temperature increases in MW/◦C. Our concerns go further to the way Energex has used MTC and ZSS peak demand to calculate percentage adjustments.

The method used by Energex appears to have a fundamental flaw in that it explicitly weights the adjustment for a ZSS by its previous peak demand[56]. The temperature

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54 ACIL Tasman report to Energex, "Forecasting Maximum Demand Zone substations, bulk supply substations and connection points; 11 kV feeders", October 2008.

55 ACIL Tasman, "Forecasting Maximum Demand, Zone substations, bulk supply substations and connection points; 11 kV feeders", October 2008, Appendix B, page B-16.

56 "the amount of additional load allocated was influenced by the zone substations' size", Zone Substations Temperature Correction Process, Energex, 2008, page 3.

sensitivity of a ZSS is completely accounted for by the MTC, which already includes the effects of ZSS size and customer composition. By scaling the adjustment by ZSS size Energex has over-estimated the necessary adjustment for large ZSS and under-estimated it for smaller ZSS.

To demonstrate this we contrast the temperature adjustments for Southport and Lawnton. The first four columns in Table 5-1 are the substation identity, 2006/07 Maximum Demand, Maximum Temperature Coefficient derived by regression and Energex's initial (base) adjustment to demand. These show that Southport and Lawnton have very similar temperature sensitivities with almost identical MTCs, however, Southports MD is more than twice than of Lawnton. According to the MTCs shown in Table 5-1 both Southport (SPO) and Lawnton should have the same adjustment, however the Energex method instead initially applies more than double the adjustment to Southport.

Table 5-1 Zone substation temperature correction parameters

ZSS	2006/07 MD	MTC	Energex Base Adjust	Mod MTC	Energex Mod Adjust	MMA Adjust
AHD	63.1	1.67	10.268	1.17	6.368	5.205
WMD	28.5	0.75	2.096	0.92	2.269	2.348
SPO	72.4	1.268	8.934	1.0744	6.726	3.946
Lawnton	32.6	1.270	4.035	1.0739	3.035	3.951

The over allocation of weather correction has been noted by Energex:

"An initial pass of the allocations revealed that they had an unrepresentatively high standard deviation. This had the impact of too much adjustment being applied to those zone substations with the higher temperature sensitivity, resulting in their corrected demand being above what could be reasonably be expected in an average season."[57]

and appears to be the reason Energex uses modified MTCs, calculated by multiplying the original MTC to the power of 0.3 (column 5). Energex's logic is that the large allocations occurs for ZSS which have large MTCs (e.g. Alexandra Headlands), but does not seem to recognise that these are also generally the ZSS with the large MDs. The modification of MTCs approach does reduce the demand of the ZSS with MTCs greater than 1, however it reduces the weather sensitivity of the adjustment and makes it further biased towards ZSS size. For example, the Modified adjustment shown in column 6 of Table 5-1 is larger for Southport than Alexandra Headlands, even though Alexandra Headlands has a much higher weather sensitivity according to the MTC.

Table 5-1 demonstrates the apparent failure of the Energex method. The modified temperature adjustments still differ by more than a factor of two for Southport and Lawnton. Note that Energex has also adjusted the Lawnton final adjustment down by 1.21 MW to 1.825 MW and that the R squared for the Lawnton correlation was 0.79 compared to 0.57 for SPO.

[57] "MMA5a – Forecasting peak demand methodology – Zone Substations.doc", Energex, 2008, page 4.

A better way to adjust the ZSS demands would appear to be to make a uniform temperature adjustment. This can be simply done using the following equation.

- ZSS_X Adj (MW) = MTC_X / Sum of all ZSS MTCs * System level 50% POE adjustment (MW)

The adjustments calculated by MMA using this method are shown in the right hand column of Table 5-1.

Overall the error in the 50% POE adjustment factor is likely to over-estimate demand at large ZSS by up to 3 MW and under estimate small ZSS by up to 1 MW.

5.4 Growth rates

Energex has developed a judgement based system at ZSS level which assesses estimated growth (high, medium, low or none) for five growth rate factors; air conditioning retrofit, detached housing, medium density units, urban renewal and commercial and industrial growth against five ZSS descriptors; domestic, mixed predominantly domestic, mixed predominantly industrial, industrial, mixed predominantly high density.

Each combination is then scored, with the resulting combined score being the growth rate used.

According to ACIL Tasman this methodology has evolved over time and appears to provide a sound simplified basis for determining zone substation demand growth rates[58].

It is very difficult to gauge whether the growth rates assessed as a result of such a system are reasonable or not without some assessment of historical accuracy. According to ACIL Tasman the growth drivers have been tested against historic zone substation growth patterns[59], but no validity testing is available.

In their assessments of the appropriate growth rates, MMA understands that the asset managers and forecasters have access to historic data which provides linear growth rate estimates over a number of time periods. However, this uses non-weather normalised data and without any compensation for load transfers and block loads.

MMA considers that a linear extrapolation of annual historical maximum demand data, after weather correction and compensation for block loads and load transfers is a good "base case" method to use in determining "organic" growth rates. If a judgementally based method is used to over-ride such a methodology, then the reason for the change should be justified and recorded.

Of the four ZSS that we examined in detail the projected growth rates appear consistent with the history for three of the four.

However, the forecast growth rate at Alexandra Headlands is much higher than the recent history would suggest. Figure 5-1 shows the trend in actual maximum demand from

58 ACIL Tasman, "Forecasting Maximum Demand, Zone substations, bulk supply substations and connection points; 11 kV feeders", October 2008, page 32.

59 ACIL Tasman, "Forecasting Maximum Demand, Zone substations, bulk supply substations and connection points; 11 kV feeders", October 2008, page 32.

2000/1 to 2004/5 was +4% per year. Then from 2004/5 to 2008/9 the maximum declined at an average rate of -4% per year. Some of this decline can be attributed to increasingly mild weather on the hottest days, however there were apparently no very large load transfers from Alexandra Headlands (less than 1 MW total[60]) and up to 8 MW of small block loads have apparently been added since 2004/05. Energex has, however, forecast growth rates of 6.5-5.5%, which is well above the historic rates.

Figure 5-1 Alexandra Headlands historic demand

In the absence of any validated historical block load and load transfer data MMA has no way to assess whether the growth rates as judged by the asset managers have been or will be reasonable. This needs to be assessed on a case by case basis. Based on the Arundel, Alexandra Headlands, Southport and West Maroochydore ZSS examples provided by Energex, MMA considers the growth rates for three of the ZSS, Arundel, Southport and West Maroochydore to be reasonable.

The Alexandra Headlands growth rates appear to be too high. The recent actual demands have declined rather than grown and there has been over 8 MW of small block loads added in the last 4 years. The forecast growth rate for Alexandra Headlands of 6.5%-5.5% does not appear consistent with the recent history.

We note, however, that the reconciliation described in Section 5.6 will help to ensure that the overall growth rates for the system as a whole reconciles with underlying growth drivers. MMA considers this to be a good feature of the Energex methodology which will help to reduce any underlying systemic growth bias.

[60] "MMA 6&10 – Block Loads and transfers.pdf", Energex response to MMA questions 6 and 10, 10/8/09.

5.5 Block Loads and Load Transfers

5.5.1 Block loads

Energex considers growth due to block loads and load transfers separately to "organic growth". It defines block loads as those constituting more than 5% of the MD of the ZSS at any time.
While the use of a percentage threshold has both positives and negatives, overall MMA considers the use of the 5% minimum size threshold filter to be reasonable.

Most DNSPs have standard methodologies for assessing the load, and level of diversity, of different block loads. MMA has reviewed the methodology according to which the size and timing of new loads are assessed[61].

Based on this assessment there are some potential issues of concern. The first is that most assessed loads are effectively 100% coincident with the ZSS summer maximum demand. In general, it is our understanding that this is often not the case. The fact that a load at Mango Hill expected to be 6.5 MW ended up contributing only 2.5 MW to ZSS maximum demand raises some concerns about the way in which these loads are estimated and the level of diversity assumed.

In addition, MMA does not consider the approach taken by Energex to "tentative" loads to be realistic. If a block load is considered tentative then Energex assumes half the load takes place in the first year and the remaining half in the second year. In essence this means that all block loads assessed by Energex are assumed to proceed – the only difference being with regard to timing – with the tentative loads being half delayed by a year.

MMA considers that such an approach is likely to result in over-optimistic assessments of block loads. Unfortunately only a very limited history of block load forecasts is available. As a result, MMA has not been able to track the reliability of Energex's block load forecasting methodology except those which were supposed to eventuate since the V31 forecasts were generated and a few whose prospects have been updated. The absence of a basis of comparison of actual outcomes versus forecasts is unfortunate as it does not allow appropriate feedback to area managers.

We have asked Energex to provide details about the block loads included in the V31 forecasts for the contributing ZSS. Block loads above the minimum threshold size were only expected in two of the contributing ZSS.

- a Harvey Norman complex due to be added in the Alexandra Headlands ZSS which were, in the V31 forecasts, expected to be complete at the end of 2009
- loads associated with the prospective Gold Coast University Hospital and Marina in the Southport ZSS which were expected to be completed between 2011 and 2013.

[61] "MMA 11 – Block Loads – treatment and process.pdf", Energex response to MMA question, 10/08/09.

According to the information provided by Energex, the status of the Harvey Norman complex has been changed from firm to tentative and the date pushed back by 2 years, although the expected load had increased a little.

Block load size and timing is crucial in planning for the proposed Parkwood ZSS. This new ZSS is driven by the 20+ MVA of block loads forecast to be added at Southport between 2011 and 2014. These block loads were forecast as 2 x 10 MVA from the Gold Cost University Hospital both due March 2011 and another 8 MVA from the Gold Coast Super Yacht Marina spread over 2012 and 2013. According to the more recent block load forecast the Marina is now expected to be built by late 2014, although presumably the load is still classified tentative, and the hospital loads are unchanged[62]. The new hospital is being funded by the government and therefore is not expected to experience the GFC-related delays of many private projects.

Energex has also provided an update of a number of smaller loads which fall under the threshold and are therefore not included separately within forecasts, but for which information is still recorded.

Of the eleven smaller block loads which had been scheduled for 2008, ten have now been completed and one is under construction. According to the update reports some of the remaining smaller block loads are also experiencing delays of one or two years.

Based on the limited evidence available, it appears that the block loads forecasts are carried out reasonably but that the effect of the GFC will be to delay a number of projects by one or two years.

In order for Energex to improve its block forecasting methodology, MMA recommends that a history of block load forecasts be retained by Energex and compared against actual outcomes in order to allow objective assessment of the accuracy of forecasts. In addition, MMA recommends that tentative projects be assigned probabilities, by year, rather than assuming they will all proceed half in the year initially forecast and half a year later.

5.5.2 Load transfers

Prospective load transfers appear to be handled well by Energex. Loads are transferred before annual growth rates are applied. The only way to improve on this would be for each transfer to have its own grow rate, however these would likely be similar to the growth rates of the ZSS involved.

When the transferred load has a different characteristic than the rest of the ZSS, a different load profile is used. As long as this new profile can be robustly determined, we expect that this extra detail will improve the accuracy of the forecasts.

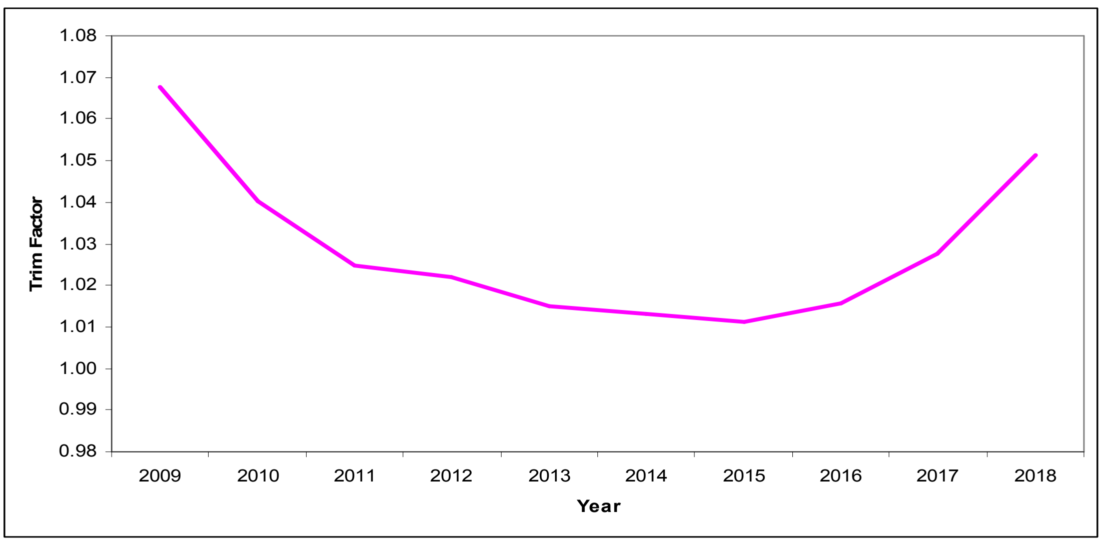
[62] "MMA10 –Block Load History.xls", Energex response to MMA question, 11/8/09.

5.6 Reconciliation with the system forecast

The combined ZSS loads are ultimately reconciled against the modelled system maximum demand using a Trim Factor to reconcile system and spatial forecasts. The 50% POE Trim Factors used by Energex over the period of concern are provided in Figure 5-2. The high Trim Factor in the year 2008/09 is understood to be due to a combination of the mild weather experienced in 2007/08 which may not have been entirely adjusted for in the 50% POE adjustment and the early year high GSP growth rates which Energex used in its system modelling.

The Trim Factor then reduces significantly for 2009/10 and 2010/11. This indicates that the relative growth rate of the summed spatial forecast is higher than that for the system forecast. For example, if the system growth rate for 2010 is 4%, then the spatial is approximately 6.75%. It is not clear why the spatial forecast should have a much higher growth rate than the system in these early years however, this difference highlights the importance of the reconciliation process.

Figure 5-2 Chart of the Trim Factor provided by Energex



MMA generally considers the use of a system and spatial reconciliation to be good practice which allows ZSS growth rates to be adjusted according to the overall key drivers.

Having said this there is a caveat. The recommendations made with regard to system MD forecasting and updating for the impacts of GFC and other inputs (see Chapter 4) need to be implemented. We expect this will significantly reduce the difference in the first couple of years and will result in Trim Factors less than one in later years – meaning the ZSS forecasts will need to be adjusted down.

5.7 10% POE to 50% POE Ratio

Energex appears to have carried out two calculations of the 50% POE to 10% POE factor for the ZSS. The “Old” method we believe is based on using MTC regressions from the 50% POE adjustment calculation and substituting in the specific 50% POE and 10% POE temperature. This is a standard approach and assuming the regressions have an acceptable R^2 coefficient then the ratio derived should be reasonable.

According to Energex the method actually used in V31 forecasts is the ACIL Tasman Monte Carlo method that is also applied to the system MD.

"In the V31 forecast, the figures used to adjust the 50 POE starting demand to a 10 POE starting demand were based on the ACIL Tasman approach to address the above issues. The factor was applied to the 50POE starting demand in MW to get the 10POE starting demand in MW."[63]

This latter method is almost completely untested at ZSS level and the information provided by Energex does not allow us to adequately test this method.

However, as the 10% POE forecasts are only occasionally used in the capex calculations and as, according to Energex[64], the ACIL Method produces similar but slightly lower ratios than the standard "Old" method we do not consider this a major issue.

5.8 Conclusions

There are several aspects to the approach taken by Energex which we consider to be good practice. These include the reconciliation of the spatial forecasts to the system forecasts, which allows changes in key drivers to be recognised, application of a threshold size to the inclusion of block loads, which acts to reduce potential double-counting and the weather correction of the ZSS starting points. While we consider the methodology actually applied to the weather correction to be flawed, we do not consider this a fatal flaw.

We note that the spatial forecasts are highly dependent on the judgment applied for future organic growth rates and this appears problematic, at least in one of the four cases we examined. While the block load forecasts we have seen also appear reasonable, this cannot be confirmed because of the lack of data which allow comparisons of block forecasts against actual timing and loads. There is thus the possibility that the estimates of size and timing of block loads may lead to premature or over-investment. In addition we have seen evidence that the GFC will result in delays, currently estimated to be of the order of 1-2 years, in several projects although this will differ between projects.

In general the impact of these methodological vulnerabilities is significantly reduced by the overall reconciliation to the system level MD forecasts, although this means that the system level forecasts have to be carried out rigorously and use timely inputs (see Chapter 4). The imperfections in the spatial forecasts may lead to some misallocation in the location of future demand growth but we have not seen any evidence that it results in large systematic biases in the forecasts.

[63] "MMA22 10POE.doc", Energex response to MMA question, 26/8/09.
[64] "MMA22 10POE.doc", Energex response to MMA question, 26/8/09.

APPENDIX A SPATIAL MAXIMUM DEMAND METHODOLOGY

Energex has claimed confidentiality over the information in this Appendix and it has been blacked out in public version.

[redacted]

i. [redacted]

[redacted]

[65] The embedded generation is predominately 1 MW land fill gas systems which run intermittently except at one or two sites. Rocky Point generator 30 MW is connected to the 110KV network and is treated separately in the connection point demand forecasts.

[redacted]

i. [redacted]

[redacted]

i. [redacted]

ii. [redacted]

iii. [redacted]

[redacted]

i. [redacted]

ii. [redacted]

iii. [redacted]

iv. [redacted]

[redacted]

i. [redacted]

ii. [redacted]

[redacted]

[redacted]

[redacted]

[66] Zone Substation Forecast, Step by Step description supplied by Energex on 25/3/09.

[redacted]

i. [redacted]

ii. [redacted]

iii. [redacted]

[redacted]

i. [redacted]

ii. [redacted]

iii. [redacted]

[redacted]

i. [redacted]

ii. [redacted]

[redacted]

[redacted]

i. [redacted]

ii. [redacted]

iii. [redacted]

[redacted]

[redacted]

i. [redacted]

ii. [redacted]

[redacted]

[redacted]

[67] In the spreadsheet provided by Energex, "AER_Scenario31_ReconcCalc.xls", various BS and DST have identical system co-incidence factors. E.g. Beaudesert, Beenleigh, Browns Plain, Coomera, Ibis, Nth Springwood, QR Beenliegh and Stradbroke Island.

[redacted]

[redacted]

[redacted]

[redacted]

APPENDIX B GLOSSARY

2010 – 2015 regulatory period	The next regulatory period for DNSPs from 1 July 2010 to 30 June 2015
A/C	Air conditioning
ABS	Australian Bureau of Statistics
ADMD	After Diversity Maximum Demand
AER	Australian Energy Regulator
APR	Powerlink's Annual Planning Report.
BSP	Bulk Supply Point
Capex	Capital Expenditures
Contributing ZSS	Zone substations which are expected to contribute load through a load transfer to a new ZSS
CP	Connection Point
DM	Demand Management
DNSP	Distribution Network Service Provider
Global or system maximum demand	Summer coincident maximum demand for the network as a whole. Typically projected on a "top-down" basis based on assessment of key drivers.
GFC	Global Financial Crisis
GSP	Gross State Product – a measure of the goods and services produced in the state in $ terms.
HIA	Housing Industry Association
Maximum Demand (MD)	Single highest measurement of half-hourly average of instantaneous demand over a period, typically winter or summer.
MTC	Maximum Temperature Coefficient. The demand response at substation level to temperature increases, measured in MW/°C
MEPS	Minimum Efficiency Performance Standards
MMA	McLennan Magasanik Associates

MVA , MW	Measures of electricity demand and maximum demand. MVA (Mega Volt Ampere) is a measure of the "apparent" power or demand. MW or Mega Watt is a measure of the real power or demand. The two measures are required because of the reactive power (MVAR) which is a measure of "losses" due to the effects of capacitance and inductance. MVA and MW are related through the Power Factor (PF).
N-1 Security Standard	The requirement that a zone substation (or other critical infrastructure) meets stipulated requirements after the failure of 1 critical element. For example, many ZSS have the requirement that they meet the 50% POE forecast on an N-1 basis, that is with one piece of critical equipment (typically a transformer) not operating.
Native Energy	Total energy demand supplied by both scheduled generating units and significant non-scheduled generating units, on a Sent Out basis, over the period.
NEM and NEMMCO	National Electricity Market and National Electricity Market Management Company Limited
NER	National Electricity Rules
NIEIR	National Institute of Economic and Industry Research
Opex	Operating Expenditures
Power Factor (PF)	The ratio of true power to apparent power in a circuit. PF = MW/MVA.
pa	Per annum
ppd	Persons per dwelling, calculated as the population divide by the total number of dwellings.
Probability of Exceedence (POE)	MD projections for each season and year are typically represented by a statistical distribution which takes into account key factors such as temperature and day type (e.g. whether a working or non-working day). An MD at a specified POE level is the estimated MD which is likely to be equalled or exceeded at that probability level. For example, a summer MD specified as 10% POE means that the probability of this MD being equalled or exceeded in the summer of that year is estimated to be 10% or 1 year in 10. A 50%

	POE MD is expected to be equalled or exceeded, on average, 1 year in 2. Distribution network planning in NSW is typically based on 50% POE forecasts.
Regulatory Proposals	Regulatory proposals submitted by the DNSPs to the AER in July 2009 relating to appropriate revenues and prices for DNSPs in Queensland from 1 July 2010 to 30 June 2015.
RC	Reverse Cycle Air Conditioning (capable also of heating)
RIN	Regulatory Information Notice
Spatial maximum demand	Summer or winter maximum demand for a small part of the network such as a transmission or zone substation. Typically projected on a "bottom-up" basis based on assessment of recent growth and spot loads.
V31 forecasts	Forecasts prepared by Energex in 2008 and used initially as the basis for its capex proposals
System or global maximum demand	Summer coincident maximum demand for the network as a whole. Typically projected on a "top-down" basis based on assessment of key drivers.
Templates	Spreadsheet templates submitted as a response to the RIN in the Proposals.
Trim Factor	Factor used to reconcile the spatial forecast to the system demand forecast.
ZSS	Zone substation

Sources: TransGrid APR 2007, NEMMCO, Energy and demand projections white paper, July 2007, MMA.