2016 AEMO TRANSMISSION CONNECTION POINT FORECASTING REPORT

FOR NEW SOUTH WALES
INCLUDING THE AUSTRALIAN CAPITAL TERRITORY

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

AEMO has prepared this document to provide information about its 2016 transmission connection point forecasts for New South Wales including the Australian Capital Territory, as at the date of publication.

AEMO publishes these connection point forecasts as requested by the Council of Australian Governments' energy market reform implementation plan.

This publication is based on information available to AEMO as at 20 July 2016, although AEMO has endeavoured to incorporate more recent information where practical.

Disclaimer

AEMO has made every effort to ensure the quality of the information in this publication but cannot guarantee that information, forecasts and assumptions are accurate, complete or appropriate for your circumstances.

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Acknowledgement

AEMO acknowledges NSW and ACT network service providers' support, co-operation and contribution in providing data and information used in this publication.

Version control

Version	Release date	Changes
1	29/7/2016	

EXECUTIVE SUMMARY

AEMO has developed Maximum Demand (MD) transmission connection point forecasts for New South Wales, including the Australian Capital Territory (ACT)[1], to provide insights to local changes and trends in MD from 2016 to 2025–26.

Together with the regional-level MD forecasts published in AEMO's *National Electricity Forecasting Report* (NEFR)[2], the forecasts provide an independent and transparent view of electricity demand in the National Electricity Market (NEM). This increased transparency is intended to lead to more efficient network investment decisions, and ultimately provide long-term benefits to energy consumers.

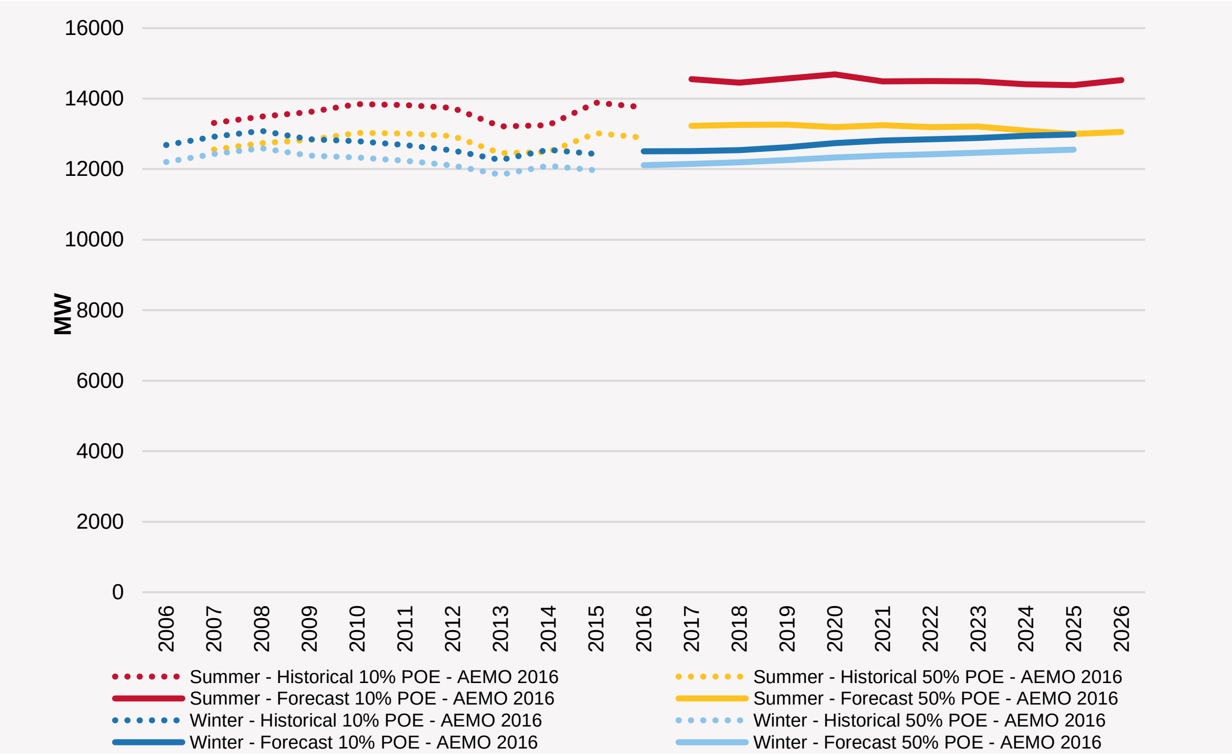
This report provides 10% and 50% probability of exceedance (POE)[3] MD forecasts, for both summer (2016–17 to 2025–26) and winter (2016 to 2025).

AEMO's forecasts of New South Wales connection point MD show:

- Summer MD is projected to remain steady over the 10-year outlook period.
- Winter MD is forecast to increase.

Figure 1 shows the summer and winter MD forecasts. Table 1 summarises the average annual forecast rates of change and main drivers of the forecasts, and compares these 2016 forecasts to those published last year.[4]

Figure 1 AEMO's aggregated, non-coincident 2016 forecasts (including direct-connect loads)



[1] New South Wales forecasts refer to New South Wales including the Australian Capital Territory.
[2] AEMO. *2016 National Electricity Forecasting Report*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report.
[3] Probability of exceedance (POE) is the likelihood that a maximum demand forecast will be met or exceeded. A 10% POE MD forecast is expected to be exceeded, on average, one year in 10. A 50% POE projection is expected to be exceeded, on average, one year in two.
[4] AEMO. *2015 AEMO Transmission Connection Point Forecasting Report for NSW including the ACT*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting.

Table 1 AEMO 2016 connection point forecast average annual rates of change, 10%POE

Category	Summer	Winter
Total connection point MD	0.0%	0.4%
Typical range of individual growth rates	–1.5 – 2.8%	–2.0 – 4.2%

Key features:

- **Improvements in appliance energy efficiency and increased generation from new installations of solar photovoltaic (PV) systems are forecast to offset growth in consumer demand arising from increasing population.**
- **Overall summer transmission connection point MD in New South Wales is expected to remain close to current levels during the outlook period.**
- **Overall winter transmission connection point MD is forecast to increase over the outlook period:**
  - **Reductions in demand for grid supplied energy from energy efficiency improvements and PV generation have a lower effect in winter than in summer.**
  - **Consumers switching from gas to electric appliances for space and water heating is projected to lead to increased winter demand.**

Compared to the 2015 forecasts:

- **The AEMO 2016 summer forecast (10% POE) is 1146 MW (8.9%) lower than AEMO's 2015 forecast at 2024–25, and the AEMO 2016 winter forecast (10% POE) is 1395 MW (12.1%) lower than AEMO's 2015 forecast at 2024.**
- **This is attributed mainly to the collective effect of differences in energy efficiency impacts modelled in the 2016 NEFR MD forecast, compared to the 2015 NEFR. These impacts were included in the connection point forecasts through reconciliation to the 2016 NEFR.**

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TABLES

FIGURES

1. INTRODUCTION

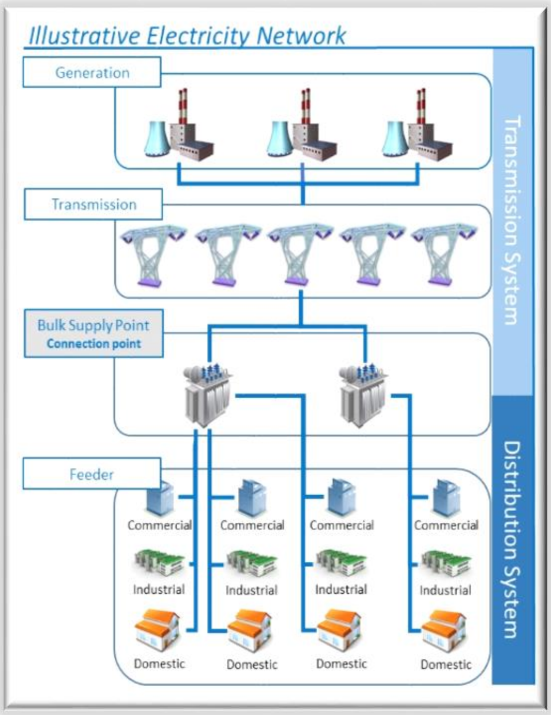
In its role as independent market and system operator, AEMO develops maximum demand (MD) forecasts for each transmission connection point, to provide a higher level of detail than AEMO's *National Electricity Forecasting Report* (NEFR) about changes in demand and observations on local trends.

Together with the regional level MD forecasts published in the NEFR, the transmission connection point forecasts provide an independent and transparent view of electricity demand in the National Electricity Market (NEM), supporting efficient network investment and policy decisions for the long-term benefit of consumers.

AEMO provides non-coincident forecasts in this report, because they represent the MD required for connection asset planning and also affect network planning. Non-coincident forecasts are the MD forecasts of a connection point, regardless of when the system peak occurs. Coincident forecasts are the MD forecasts of a connection point at the time system peak occurs.

1.1 Connection point definition

AEMO's connection point forecasting methodology[5] defines a transmission connection point as the physical point at which the assets owned by a transmission network service provider (TNSP) meet the assets owned by a distribution network service provider (DNSP), as illustrated (right).



These may also be known as bulk supply points (BSPs), terminal stations, or exit points, and in the NEM's market metering and settlements processes they are called transmission node identities (TNIs).[6]

Connection points may be connected to one another at the distribution network level. In situations where this interconnectivity is extensive, AEMO develops a forecast for the aggregated load.

1.2 Forecast scope

The forecasts in this report:

- Apply to active power in megawatts (MW) at each connection point (see Section 1.3 for information about accessing reactive power estimates).
- Exclude transmission system losses and power station auxiliary loads.

Embedded generators, which are mentioned in the dynamic interface (see Section 1.3), are assumed to be off at the time of forecast MD.

Where there is just one customer at a connection point, AEMO has only published forecasts if the customer has given permission.

[5] AEMO, *Transmission Connection Point Forecasting Methodology 2016*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting.

[6] For a complete list of TNIs, refer to *List of Regional Boundaries and Marginal Loss Factors for the 2016-17 Financial Year*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Loss-factor-and-regional-boundaries.

1.3 Supplementary information on AEMO's website

Supplementary information to this report is available on AEMO's website.[7]

Resource	Description
Dynamic interface **http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting**	An Excel workbook with the following information for each transmission connection point: • Historical and forecast MD, including 10% POE and 50% POE, for active power. • Coincident and non-coincident values. • High-level commentary. • The option to export all forecast and historical data.
Reactive power system forecast spreadsheet **http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting**	Separate spreadsheet for reactive power forecasts at each transmission connection point, providing complementary information for power system studies.
Interactive planning map **http://www.aemo.com.au/aemo/apps/nem_map/index.php**	The interactive map complements AEMO's planning publications to enhance readability and clarity. The map contains various layers, including layers displaying forecasts and planning information.
Transmission Connection Point Forecasting Methodology 2016 **http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting**	The current AEMO transmission connection point forecasting methodology outlines the process through which the forecasted were developed.

1.4 Improvements to the forecasting methodology

Since publishing the 2015 forecasts, AEMO has completed process improvements focussed on data management and improved analytical capability. These will set the foundation for the next program of modelling and methodological improvements.

AEMO's *Transmission Connection Point Forecasting Methodology 2016* represents the current state of AEMO's transmission connection point forecasting methodology, and was employed to develop the forecasts presented in this report.

The key changes implemented in the 2016 forecast compared to 2015 are summarised in Table 2.

Table 2 Improvements implemented for New South Wales connection point forecast, since 2015 forecast

Improvement description	Approach	Benefit	Implemented
Investigate opportunities to improve the reconciliation process.	Reconcile the non-coincident forecasts to the general rate of change of the system forecast, rather than derive them from coincident forecasts using diversity factors.	Regional-level drivers of growth are included by reconciling to the growth rate.	Yes

[7] Supplementary information is available at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting.

2. RESULTS

2.1 Background

Historically, in New South Wales:

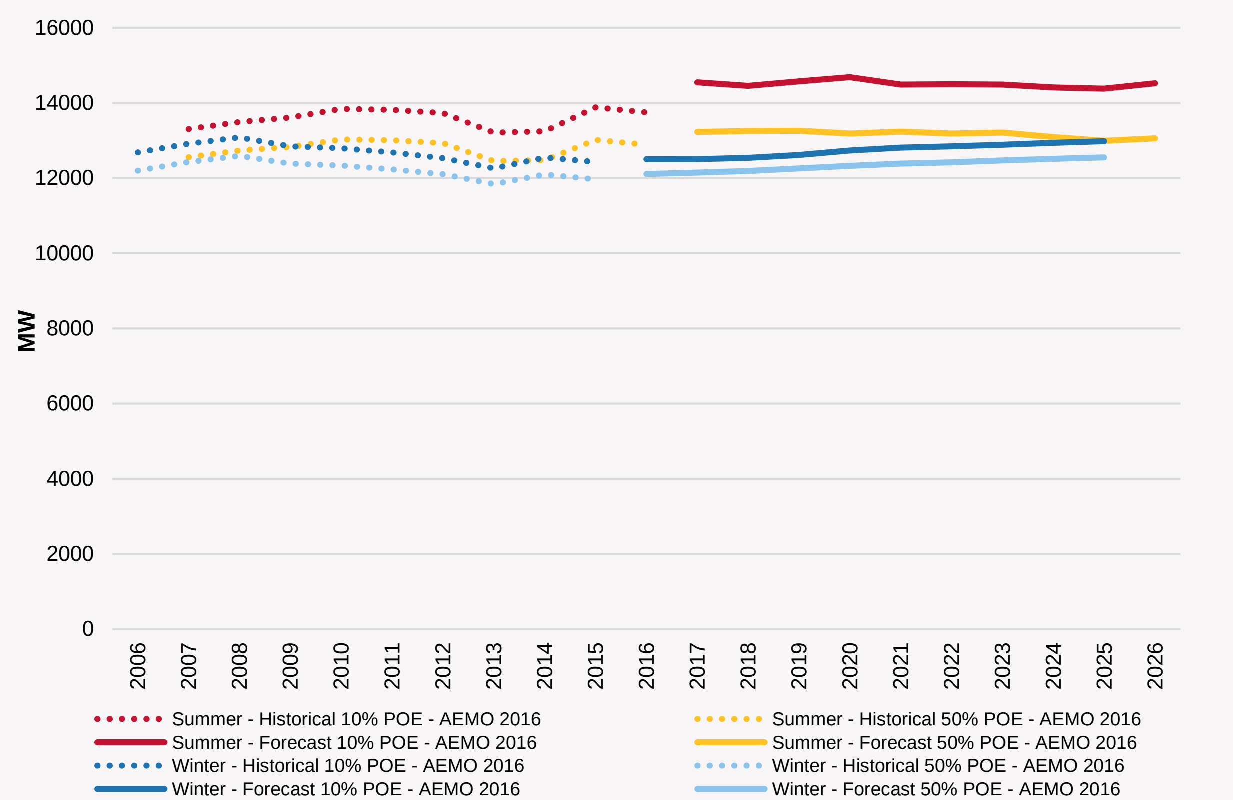
- Summer MD increased overall after 2007, with a period of lower demand from 2013 to 2014. New South Wales has historically exhibited higher MD in summer than winter, due to the widespread use of cooling appliances.
- Winter MD peaked in 2008 before entering a period of steady decline until 2013. The 2014 and 2015 winter MDs were both above the 2013 MD.

2.2 Aggregated AEMO 2016 connection point forecasts

AEMO's aggregated forecasts of New South Wales connection point MD (see Figure 2) show:

- Summer MD is predicted to remain steady, with only a negligible decrease visible in the 50% POE forecast by the end of the 10-year outlook period.
- Winter MD is predicted to steadily increase at a regional average growth rate of 0.4% per annum in the 10% POE and 50% POE forecasts.
- The aggregate summer and winter forecasts are converging, although summer MD remains above winter MD throughout the outlook period.

Figure 2 AEMO's aggregated, non-coincident 2016 forecasts (including direct-connect loads)



The forecasts are reconciled to AEMO's 2016 NEFR, which incorporates the effects of forecast population growth, increases in electricity prices, fuel switching, appliance usage, manufacturing, rooftop photovoltaic (PV) systems, and energy efficiency in appliances and buildings.

Key insights from the aggregate-level forecasts are:

- Improvements in appliance and building energy efficiency, as well as increasing generation from new installations of rooftop PV systems, are forecast to offset growth in consumer demand.
- Population growth is seen as the key driver in consumer demand, with increased uptake and usage of electric appliances also playing an important role.
- Energy efficiency savings for air conditioners are forecast to be higher than for many other appliances, lessening the impact of increasing uptake in space cooling on summer MD. Older, less-efficient, air conditioners are expected to be replaced with newer types, so less electricity is required for cooling on hot, high demand days. The efficiency gains are forecast to impact residential and commercial MD to a greater extent than industrial MD.
- Strong growth of rooftop PV uptake is forecast to continue, with an 11.6% average annual increase in installed capacity predicted across the region between 2017 and 2026.
- Increasing generation from rooftop PV acts to both reduce MD and move the time that the peak occurs to later in the day.
- The effects of rooftop PV generation and space cooling energy efficiency improvements reduce summer MD more than winter MD, leading to a flat summer forecast when compared to the increasing winter forecast.
- A 51.9% penetration of reverse-cycle air-conditioning in New South Wales households[8] means the majority of homes have the ability to use electricity for highly efficient space heating. Gas to electric appliance switching is expected to occur as consumers begin to pursue this option for heating, adding to the projected growth in winter MD across the outlook period.

2.3 Individual AEMO 2016 connection point results and insights

While the regional aggregate trend shows summer MD remaining close to current levels and an increasing winter MD, individual connection point forecasts[9] increase at some locations, and decrease at others, due to various drivers. Table 3 shows connection points with average annual increases or decreases of more than 2%, as well as the drivers of demand. Appendix A shows plotted individual 10% POE rates of change for each connection point in New South Wales.

Key features of the summer forecasts are:

- Forecast average annual rates of change for 10% POE are between –1.5% (Mullumbimby 132 kV) and +2.8% (Murrumbateman). Drivers are listed in Table 3.
- 79% of connection points show positive growth or no growth over the outlook period for their 10% POE average annual rates, with 68% of these having small growth rates between 0.0% and 1.0%.
- The Sydney Region is the largest connection point in New South Wales, with a 4,361 MW 10% POE MD forecast for summer 2017. It is predicted to have a –0.9% average annual decline in summer MD over the outlook period, offsetting the positive growth shown by the majority of connection points.
- 11% of connection points are predicted to change from having summer peaking to winter peaking 50% POE forecasts within the outlook period. This aligns with the prediction of increasing aggregate winter demand and flat summer demand, and is likely due to the impact of energy efficiency in space cooling during summer and fuel switching from gas to electricity in winter.

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[8] Australian Bureau of Statistics, *Environmental Issues: Energy use and conservation*, cat. No. 4602.0, March 2014.

[9] Refer to the dynamic interface for detailed information on individual connection points. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Transmission-Connection-Point-Forecasting.

Key features of the winter forecasts are:

- Forecast average annual rates of change for 10% POE are between –2.0% (Mullumbimby 132 kV) and +4.2% (Darlington Point). Drivers are listed in Table 3.
- 86% of connection points are forecast to have positive growth or no growth for their 10% POE average annual rates. Of these, 61% have a growth rate above 1.0%, reflecting the aggregate trend of increasing winter MD.
- 14% of connection points are forecast to have negative growth for their 10% POE average annual rates, indicating that the forecast positive winter growth trend is exhibited in the vast majority of connection points.

Table 3 Drivers at connection points with average annual increase or decrease greater than 2%[a]

Season	Forecast MD increase greater than 2%	Forecast MD decrease greater than 2%
Summer MD	The following 3 connection points show positive summer growth due to increasing population: **Murrumbateman** **Marulan (Essential Energy)** **Yass 66 kV**	None.
Winter MD	The following 14 NSW connection points show winter growth greater than 2%, reflecting the aggregate winter trend. Drivers include population growth and gas to electric fuel switching, with PV and energy efficiency improvements having less of an effect on MD in winter compared with summer: **Darlington Point** **Wallerawang (Endeavour Energy) 66kV and 132kV** **Stroud** **Macksville** **Boambee South** **Tomago (Essential Energy)** **Marulan (Essential Energy)** **Heron's Creek** **Manildra** **Wagga North 66kV** **Yanco** **Inverell** **Mullumbimby 11kV** **Narrabri**	**Mullumbimby 132 kV**

[a] 2% is set to capture extreme rates. Major industrial loads are excluded due to confidentiality.

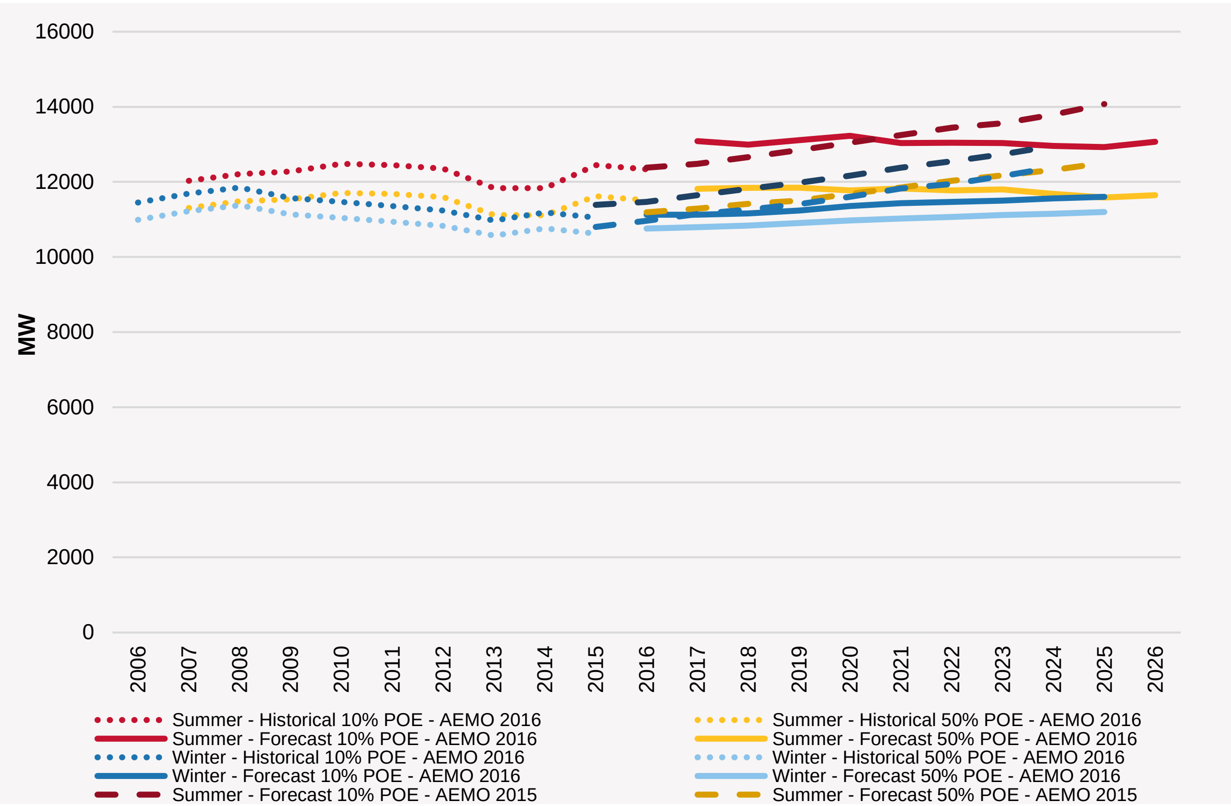
2.4 Comparison of AEMO's 2015 and 2016 forecasts

AEMO's aggregated 2015 and 2016 connection point MD forecasts for New South Wales are plotted in Figure 3, and the growth rates are compared in Table 4.

- Summer 10% POE MD forecasts are 8.9% lower at 2024–25.
- Winter 10% POE MD forecasts are 12.1% lower at 2024.

Reasons for these changes are summarised in Table 5.

Figure 3 AEMO 2015 and 2016 aggregated, non-coincident connection point MD forecasts (excluding direct-connect loads)[a]



[a] The figure excludes direct transmission-connected customer load forecasts which are not distribution-connected and not included in DNSP distribution network forecasts. Connection point forecasts by DNSPs are used as the basis for comparison in both Figure 3 and Figure 4.

Table 4 Region-level average change rates (10% POE)

Forecast	2015 Region level average annual change rate	2016 Region level average annual change rate
Summer MD	1.3%	0.0%
Winter MD	1.3%	0.4%

Table 5 Differences between AEMO 2015 and 2016 forecasts (10% POE)

Forecast	Differences between AEMO 2015 and 2016 aggregated MD forecasts (10% POE)
Summer MD	AEMO's 2016 connection point forecast is 8.9% (1146 MW) lower than the previous forecast at 2024–25.
Winter MD	AEMO's 2016 connection point forecast is 12.1% (1395 MW) lower than the previous forecast at 2024.

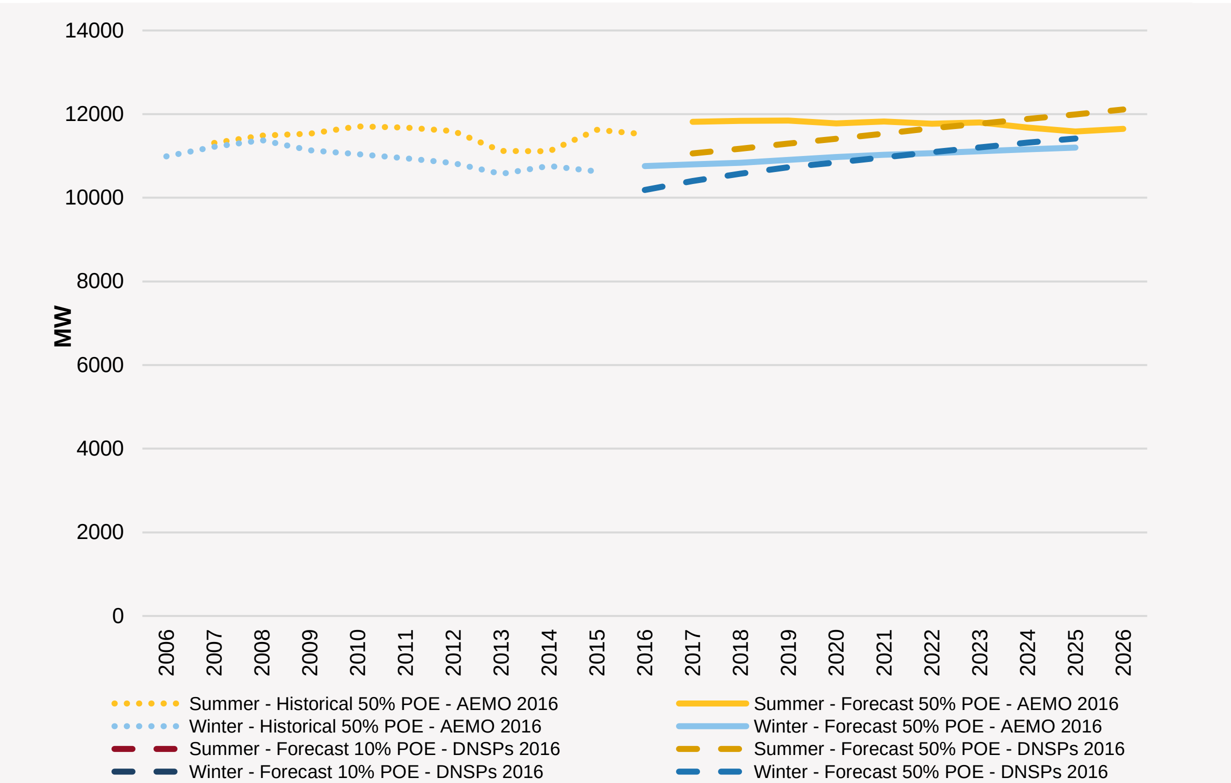
Key drivers for change:
- **Increased impact of energy efficiency in buildings and new appliances, in the 2016 NEFR, in contrast to the impacts modelled in the 2015 NEFR. These differences are attributed to changes in NEFR forecasting methodology.**
- **The growth rate projection for the manufacturing sector was lower in the 2016 NEFR compared to the 2015 NEFR, reflecting the results of additional industry analysis over the past year.**
- **Methodology changes in the connection point forecasting process, as outlined in Table 2 above.**

2.5 Comparison of AEMO 2016 forecasts and DNSP 2016 forecasts

At the end of the outlook period, AEMO's New South Wales summer connection point MD (50% POE) forecasts are 4.0% lower than those of the DNSPs. AEMO's winter MD (50% POE) forecasts are 2.0% lower than those of the DNSPs.

Figure 4 plots the comparison.[10] AEMO's forecasts start higher than those of the DNSPs in both summer and winter, however the lower growth rate of AEMO's forecasts leads to them crossing over those of the DNSPs toward the end of the outlook period.

Figure 4 AEMO and DNSP aggregated, non-coincident 50% POE forecasts[a]



[a] The figure excludes direct transmission-connected customer load forecasts which are not distribution-connected and not included in DNSP distribution network forecasts. Connection point forecasts by DNSPs are used as the basis for comparison in both Figure 3 and Figure 4. Transgrid does not publish 10% POE forecasts.

[10] DNSP forecast data obtained from Transgrid, *New South Wales Transmission Annual Planning Report 2016*. Available at: https://www.transgrid.com.au/news-views/publications/Documents/Transmission%20Annual%20Planning%20Report%202016.pdf.

The key differences between the 2016 AEMO forecasts and the DNSP forecasts are summarised in Table 6. Table 7 summarises key areas contributing to these differences.

Table 6 Differences between AEMO and New South Wales DNSP forecasts

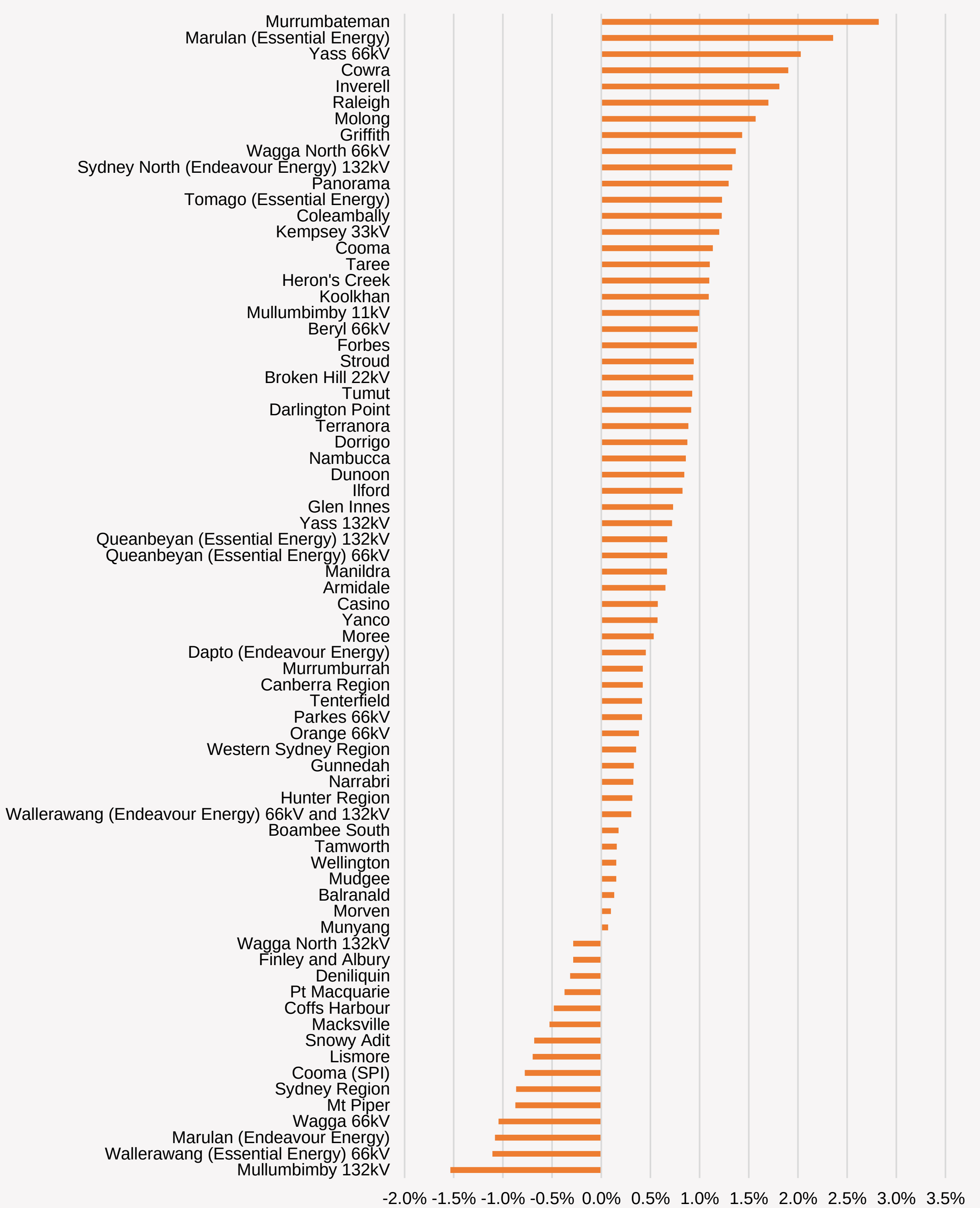
Forecast	Differences between AEMO and DNSP aggregated MD forecasts (50% POE)
Summer MD	AEMO's connection point forecast is 4.0% (463 MW) lower than the New South Wales DNSP forecast at 2025–26.
Winter MD	AEMO's connection point forecast is 2.0% (217 MW) lower than the New South Wales DNSP forecast at 2025.

Table 7 Identified differences between AEMO and New South Wales DNSP methodologies

Description	AEMO	New South Wales DNSPs
Reconciliation to state level forecasts	Forecasts are reconciled to the 2016 NEFR.	DNSPs do not reconcile to a state level forecast.
Energy efficiency	Impact of energy efficiency improvements is incorporated by reconciling to the NEFR.	Not all DNSPs consider energy efficiency in their forecasts.

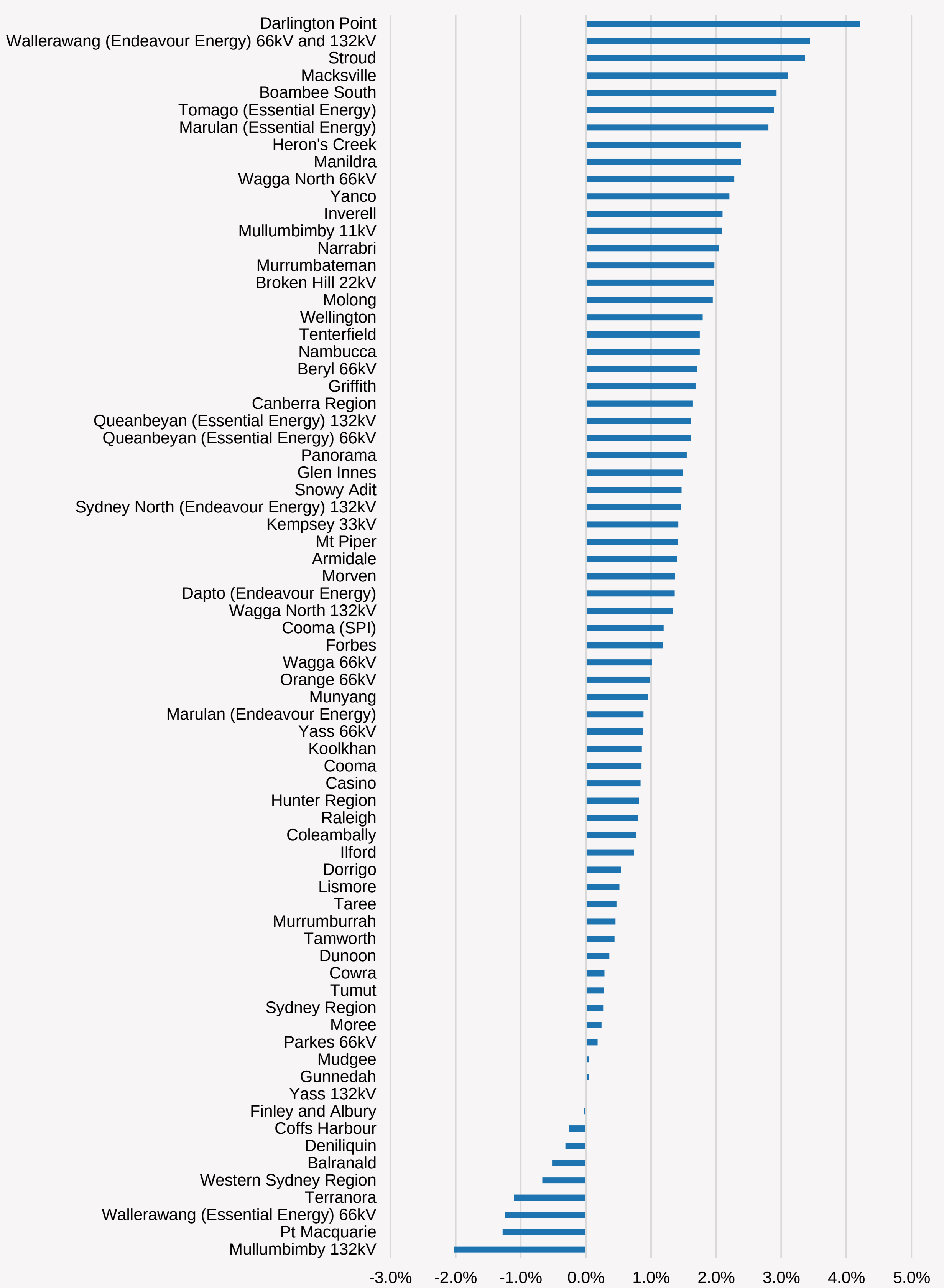
APPENDIX A. GROWTH RATES BY CONNECTION POINT

Figure 5 New South Wales 10% POE summer 10-year average annual growth rates, 2016–17 to 2025–26[a]



[a] Some direct-connect industrial loads are excluded due to confidentiality.

Figure 6 New South Wales 10% POE winter 10-year average annual growth rates, 2016 to 2025[a]



[a] Some direct-connect industrial loads are excluded due to confidentiality.