Appendix 1.1:
The Centre for International Economics – Evoenergy electricity demand forecasts

Revised regulatory proposal for the Evoenergy electricity distribution determination 2024 to 2029

November 2023

FINAL REPORT

Evoenergy electricity demand forecasts

Response to AER's draft decision

Prepared for
Evoenergy

8 November 2023

THE CENTRE FOR INTERNATIONAL ECONOMICS
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Executive summary

The CIE has undertaken a review of the electricity demand forecasts developed by Evoenergy as part of its revised submission to the AER. As part of this we have also considered the AER's recommended changes to Evoenergy's demand forecasting methodology.

Our key findings are as follows:

- the AER's draft decision made valid points regarding the potential for duplication in block loads and the transparency of the forecasting approach. Evoenergy's revised forecasts have addressed these issues to the extent possible in available timeframes
- the system forecasts from AER's draft decision suggest growth well below other sources, such as AEMO projections for NSW and Victoria, although we note that these were intended as a placeholder. We also consider that the starting point that was replicated from Evoenergy's forecasts is too low
  - this suggests that while the specific issues raised by the AER are valid, their resulting forecasts do not appear to be reasonable in light of other projections
- Evoenergy's revised forecasts have improved on those from its initial submission, in particular through:
  - an improved approach to accounting for non-EV block loads at the feeder, zone substation and system level
  - using more up to date information for electric vehicle impacts on peak demand
  - a closer alignment of growth at the system level and across zone substations
- Evoenergy's forecasts are lower than forecasts from a range of other sources for different jurisdictions, despite there being limited reasons to expect demand growth in the ACT to grow more slowly than the other jurisdictions
- There are reasons to expect that there is some degree of conservative bias remaining in Evoenergy's forecasts in respect of:
  - the starting point for winter maximum demand. Evoenergy uses an 'off the line' model, estimated over the period 2007 to 2023. The estimated starting level is potentially understating maximum demand, with demand being higher than the starting 50% PoE for many days in 2023, both at the system level and across zone substations. This likely reflects changes to the drivers of winter peak demand that are not included in the modelling framework
  - gas to electricity substitution is one of the factors not accounted for in Evoenergy's forecasting approach. It is likely that this will have a material impact on winter peak demand and overall peak demand, as gas heating increasingly switches to electric ahead of the planned phase out of fossil fuel gas by 2045 in the ACT.[1]

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[1] See: https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/barr/2022/powering-canberra-our-pathway-to-electrification .

1 Background

There are a range of AER and AEMO documents that set out principles for forecasting that can be used as part of assessing Evoenergy's approach. These include principles around processes used to develop forecasts, as well as principles for the forecasts themselves. Table 1.1 sets out general principles developed by the AER and applied by AEMO in relation to state and overall system maximum demand forecasts. The principles most relevant to Evoenergy are intuitive:

- the forecasts should aim to be unbiased and accurate
- the forecasts should be transparent, and
- the drivers of the forecasts should be transparent.

1.1 Summary of principles from AER and AEMO general forecasting guidance

	AER forecasting best practice guidelines	AEMO electricity demand forecasting approach
Process principles	Transparent methodology and inputs Stakeholder input/engagement Post period performance reviews	Consultation Transparent
General forecast principles	Accurate and unbiased Transparent drivers of forecasts/effects of inputs Scenario and sensitivity analysis for individual forecasts	Accurate

Source: AER Forecasting Best Practice Guidelines, https://www.aer.gov.au/system/files/AER%20-%20Forecasting%20best%20practice%20guidelines%20-%2025%20August%202020.pdf; AEMO 2023 Forecasting approach electricity demand, https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2023/forecasting-approach_electricity-demand-forecasting-methodology_final.pdf?la=en.

Of more specific relevance to this exercise is the approach AEMO uses for transmission connection point maximum demand forecasts.[2] The steps AEMO takes are shown in chart 1.2.

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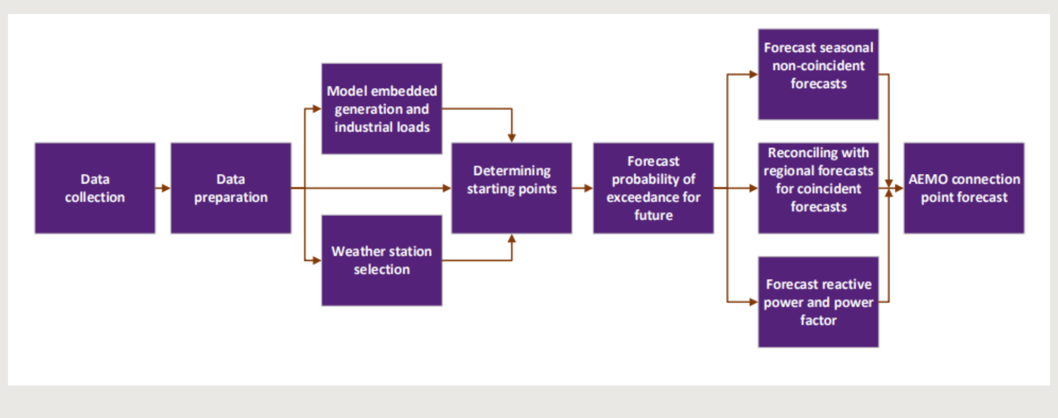
[2] AEMO 2021 Connection Point Forecasting Methodology, https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/tcpf/2021-connection-point-forecasting-methodology.pdf?la=en

1.2 AEMO steps for transmission connection point forecasting



Data source: AEMO 2021 Connection Point Forecasting Methodology, https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/tcpf/2021-connection-point-forecasting-methodology.pdf?la=en; Figure 4.

Of specific relevance from AEMO's approach is that they:

- take half hourly data for each TCP and:
  - adds estimated embedded generation to the transmission connection point demand, to give total demand before the effects of embedded generation
  - removes industrial loads to give a cleaner measure of commercial and residential demand
- model a whole range of time periods, using all available data — for example all half hour summer afternoons
- develop a starting point for the forecasts based on recent data corrected for weather
- apply specified drivers to grow (or reduce) the forecast, including:
  - number of connections
  - battery storage, electric vehicles (EVs), PV, and other new embedded generators
  - probable loads not otherwise captured by customer growth or behind-the-meter technologies (block loads)
  - decommissioning of existing embedded generators
- reconciling to regional forecasts, which can result in upwards or downward adjustments across all TCPs. This appears to only be done for coincident forecasts.

2 AER draft decision

The AER was not satisfied with Evoenergy's proposed demand forecast and substituted a lower demand forecast at both the system wide and zone substation levels. The AER's alternative demand forecast for the 2024–29 regulatory control period is:

- 38 MVA for system wide peak demand growth, which is 44 per cent lower than Evoenergy's proposed demand forecast growth of 68 MVA
- 43 MVA for zone substation demand growth, which is 70 per cent lower than Evoenergy's proposed demand forecast growth of 140 MVA.

Key reasons for the AER's decision to reduce demand were:

- reductions in the impact of electric vehicles on demand, based on new information not available to Evoenergy at the time of submission of its forecasts, and
- reductions in the non-electric vehicle block loads for residential and commercial activities, based on concerns that these double count with trends estimated in the forecasting model.

AER also noted a number of other concerns with the modelling approach, although it did not make changes to the forecasts in respect of these.

The sections below set out the AER adjustments, our view of whether these are reasonable and whether the resulting projection is reasonable.

Adjustment for EV block loads (alternative EV block loads)

The AER revised the adjustments for EV loads from 48MVA to 20MVA. It accepted Evoenergy's method and then applied revised more recent inputs such as the charging profile of EVs. The revised EV projections were provided by Evoenergy.

AER also noted that Evoenergy should address the following in its revised proposal:

- for the zone substation peak demand, Evoenergy should take a more sophisticated assumption than winter evening peak for EV block loads to properly account for the various hourly load profiles for EV charging across zone substations which may have different peak times
- Evoenergy should continue to update its forecasts to reflect the latest inputs from AEMO
- provide greater transparency around the underlying assumptions applied for EV demand forecasts to inform the demand forecasting and augmentation capital expenditure assessment

- further revise the assumption on EV uptake (based on the updated ACT Government forecast) and charging profile on an energy per vehicle basis and zone substation peaking time.

The AER largely applied the EV block load forecast but made an adjustment to remove the EV load from 2022 to derive block loads which start from 2023. We understand that the logic of this adjustment is to remove the loads from EVs already connected on the basis that they are included in 2022 load. However, the historical EV uptake is unlikely to be well reflected in Evoenergy's trends in its model. This is because Evoenergy uses a level approach which is akin to using an average over the historical data set for factors not explicitly modelled (time and temperature). Over most of historical data set (from 2007 to 2023) EV uptake has been modest.3 As a result, we consider that the best forecast would be based on the total number of EVs not just the EVs purchased in 2023 onwards.

Rejection of block loads for new developments

The AER did not accept Evoenergy's approach for block loads for new development. This largely reflected a concern that the block loads included could duplicate with time trends estimated in the statistical models. The AER indicated that Evoenergy should refine its approach with the following considerations:

- block loads above the trend should be removed from the historical period and added to the forecast period to prevent duplications that have been captured within the trend component of the demand forecasts. This is to ensure only the demand impact driven by factors such as population, economic growth, energy prices, demand management, CER and energy efficiencies is carried to the forecast period as part of the trend projection
- adjustments for block loads above the long-term trend should be observed for any trend estimated, regardless of whether the trend is estimated to be positive or negative. This is because the trend can result from an offset between the increasing demand from population and economic growth and the decline in the historical period due to other long-term demand drivers (for example, rising electricity prices, demand management, photovoltaic systems, battery storage and greater energy efficiencies)
- fundamentally it is population and economic growth that drives electricity consumption and demand in the longer term. Evoenergy should take into account its historic understanding of the drivers affecting electricity demand to ensure the residential and commercial block loads only reflect the forecast above the trend
- Evoenergy included a threshold of 0.5 MVA to identify large residential, commercial, or mixed development so that these large projects can be added to the block load

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[3] Prior to 2023 EV's accounted for less than 1 per cent of registered light vehicles in the ACT and at the being of 2015 account for 0.04 per cent of registered vehicles compared to 1.8 per cent of light vehicles in October 2023. Prior to 2015, the number of EVs in the ACT is likely to be negligible (less than the 122 registered in 2015). Data on EV registration in the ACT is available here: https://www.data.act.gov.au/Transport/Total-vehicles-registered-in-the-ACT/x4hp-vihn.

forecast. However, this threshold is not consistently applied to prevent double counting in the baseline trend.

Under Evoenergy's modelling approach for its initial proposal, and with the data available to it, we agree with the AER that there is a potential risk of duplicating block-load adjustments and time trends. For example, where a zone substation has had substantial historical growth, then this would lead to a positive time trend. Adding block loads related to future population growth would then likely double up on the time trend.

Evoenergy has revised its approach to block loads in response to the AER's feedback. This has primarily consisted of incorporating a "load inclusion criteria" into the model to inform when block load adjustments should be incorporated into forecasts and to avoid double counting between the trend and block loads (see chapter 3 for further detail). Note that we understand that it has not been possible to remove block loads from the historical analysis in a consistent way with the projections.

We think the approach to block loads will likely differ at different levels of the network, and the AER should be careful in how revisions to zone substation forecast are applied to individual feeders, in terms of impacting on capital expenditure requirements. Feeder level projections of demand will be more usefully informed by specific identified block loads than more general trend approaches. It is not clear how EMCA or AER make adjustments to feeder projections resulting from the AER's changes in system and zone substation level forecasts. It appears that at least in some instances, feeder level adjustments are applied as proportional reductions to the zone substation forecast.[4] This approach may not make sense when the AER's demand revisions relate to the removal of block loads, while removing these at a feeder level would result in a less well-informed forecast.

Other commentary on forecasting approach

AER considered that Evoenergy should address the following additional demand forecasting related matters its revised proposal:

- further consideration of individual demand drivers such as population and economic growth, price changes, demand management including time-of-use tariffs, and technological changes like energy efficiency, consumer energy resources, and their demand impact.
- the methodology for forecasting non-EV peak load needs to be more comprehensive, with a clear and detailed outline of the method used. Deviations from this methodology should be thoroughly explained and justified. This extends not only to individual projects, but also for different load types, the project probability used, and the application of seasonal factors
- the consideration of a consistent time period for its historic data to model the demand at the system wide level and zone substations, and an explanation of the rationale for the chosen periods

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[4] Energy Market Consulting Associates, Review of proposed expenditure on DER and Augex, section 158.

- provide further explanations on assumptions applied to take account of the impact from gas to electricity conversions and time-of-use tariffs
- provide further clarification on how the method is applied using the sample data and supporting evidence along with summary information to estimating the maximum demand for projects as well as for different types of load
- provide a clearer rationale for the selection of specific input parameters, especially in cases where discrepancies or variations in inputs have been introduced.

We agree that greater transparency of the Evoenergy forecasting approach is desirable for future regulatory submissions. Bayesian modelling is complex to understand, and more so than standard empirical analysis, so additional transparency of the process, data and estimates would be useful.

Another form of transparency is comparing the forecasts to other forecasts. When AEMO has developed new transmission connection point forecasts then this would be a useful source. However, these were last available in 2020, which we consider too dated for this exercise. Comparison of growth profiles to high level NSW and Victoria forecasts and forecasts of other distributors can also provide an indication of the reasonableness of the projections, given the different demand pressures in these locations relative to the ACT. We show these comparisons in the following section.

Assessment of overall AER forecasts

While we agree with many of the points made by AER around Evoenergy's demand forecasts, it is useful to understand whether the resulting projections themselves appear reasonable. In doing this, it should be noted that AER's forecasts are intended as a placeholder.

At the system level, we consider that the forecasts that result from AER's adjustments have the following concerns at the system level:

- the forecasts start too low. The AER's 50% PoE forecasts start at 634 MW in 2023. It is now evident from more recent data that this starting point should be higher:
  - 2022 winter peak was 685 MW
  - 2023 winter peak was 690 MW

  This is replicating Evoenergy's initial forecasts, which also started too low in 2022/23. This means revisions to Evoenergy forecasts should have a higher starting point than AER's placeholder projections
- the AER's forecast growth in peak demand from 2023 to 2032 is likely too low at 11.7 per cent or 1.2 per cent per year. In comparison (table 2.1):
  - AEMO's forecasts for NSW peak demand from the 2023 ESOO over the same period, for its central scenario, are for growth of 18.1 per cent or 1.9 per cent per year
  - AEMO's forecasts for Victorian peak demand from the 2023 ESOO over the same period, for its central scenario, are for growth of 30.2 per cent or 3.0 per cent per year

- GHD and Acil Allen’s modelling for the ACT Government on electric vehicles has base case peak demand growth of 23.0 per cent or 2.3 per cent per year[5]

2.1 Comparison of AER system forecasts and other forecasts

Source	Geography	Scenario	Growth 2023 to 2032	Growth per year
			Per cent	Per cent
AER draft decision	Evoenergy system	NA	11.7	1.2
AEMO ESOO 2023	NSW	Central	18.1	1.9
AEMO ESOO 2023	Victoria	Central	30.2	3.0
GHD	Evoenergy system	Base case (winter)	23.0	2.3

Note: Forecasts are 50% PoE.

Source: As noted in table.

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[5] GHD 2023, Technical and Economic Modelling of the ACT Electricity Network, Supplementary Report: Updated Electric Vehicles uptake, 6 April 2023.

3 Evoenergy's revised forecasts

Evoenergy has revised its methodology to develop block load adjustments following comments for the AER. This has consisted of revised methodologies for EV-related and non-EV related block loads. The methodology for the other elements of the forecasts, namely the approach to estimating the historical trend, remain unchanged.

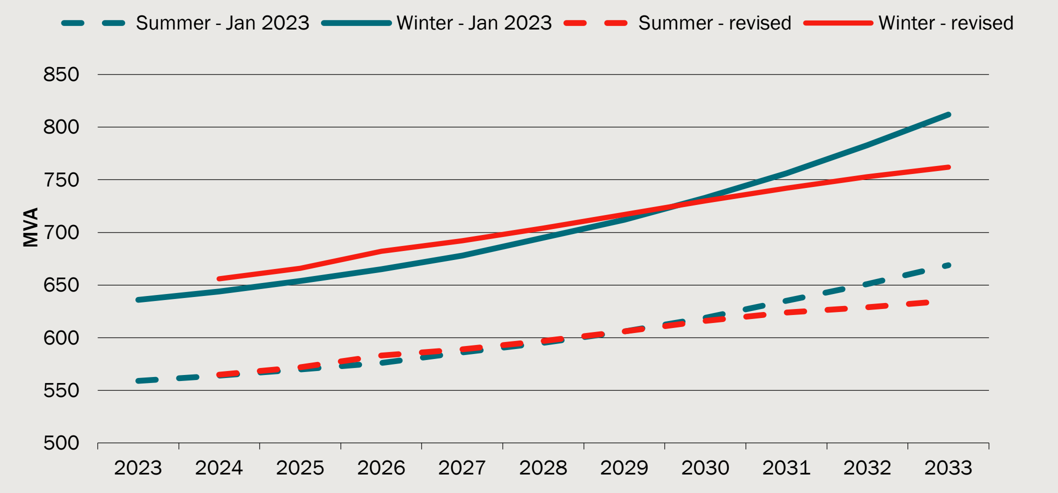
These changes have been motivated by:

- AER's concerns around double counting of non-EV block loads
- AER's comments around including the most up to date information for EV block loads

Evoenergy's revised forecast

Evoenergy's updated forecasts for summer and winter for the overall system are shown in chart 3.1. The updated forecasts are slightly higher than the January 2023 forecast submitted to the AER until 2029 (peaking at around 2.6 per cent higher in 2026 winter and 1.2 per cent higher in 2026 Summer), after which they are significantly lower (around 6.2 and 5.1 per cent lower in winter and summer respectively in 2033). This pattern is repeated for both winter and summer maximum.

3.1 System maximum demand forecast – 50%POE

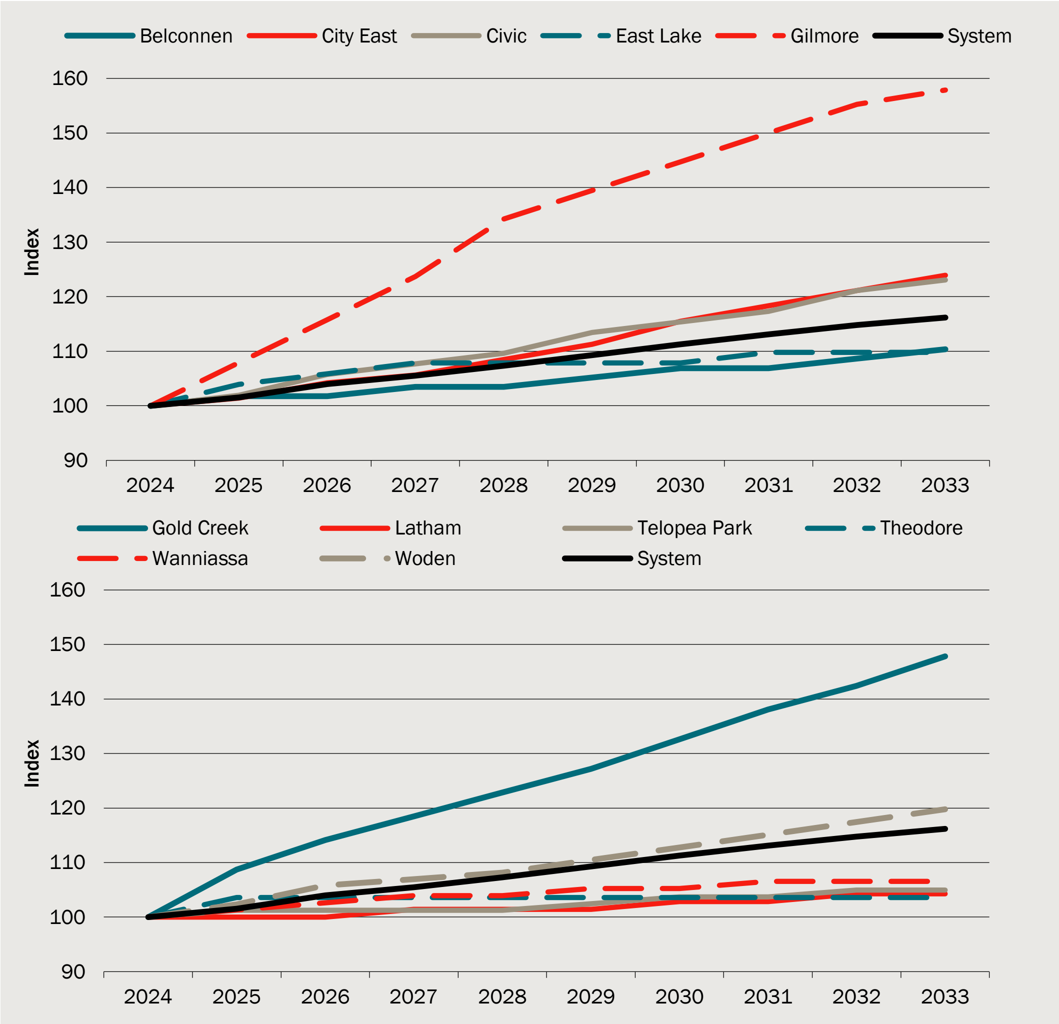


Note: Dates are financial years; 2024 represents FY 2023/24.

Data source: Evoenergy.

The revised projections for winter peak demand at a zone substation level are shown in chart 3.2. Demand is anticipated to grow for all zone substations, with the most rapid growth for Gilmore and Gold Creek due to strong trend growth.

3.2 Revised maximum demand forecasts by zone substation, winter 50% PoE

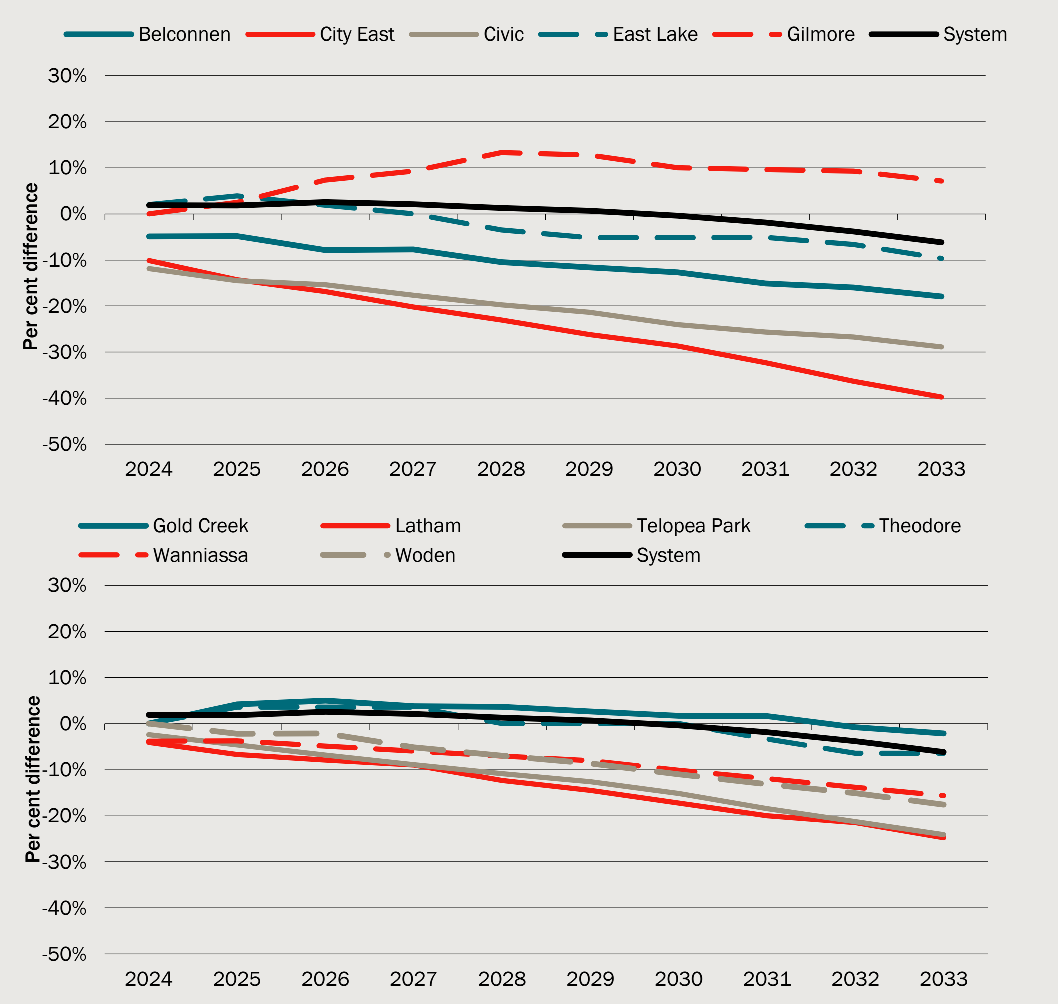


Note: Dates are financial years; 2024 represents FY 2023/24. Indexed to 100 for 2024.

Data source: Evoenergy.

By zone substation, the results are somewhat mixed, with some zone substations experiencing larger falls than others. For some zone substations, demand is higher than January 2023 forecasts (charts 3.3 and 3.4). The differences between these will reflect the size of the residential and mixed/commercial block loads which have been excluded from forecasts (all else equal, a larger difference between the updated and January 2023 forecasts imply a larger residential and mixed/commercial block load included in the January 2023 forecasts), as well as changes to EV block loads.

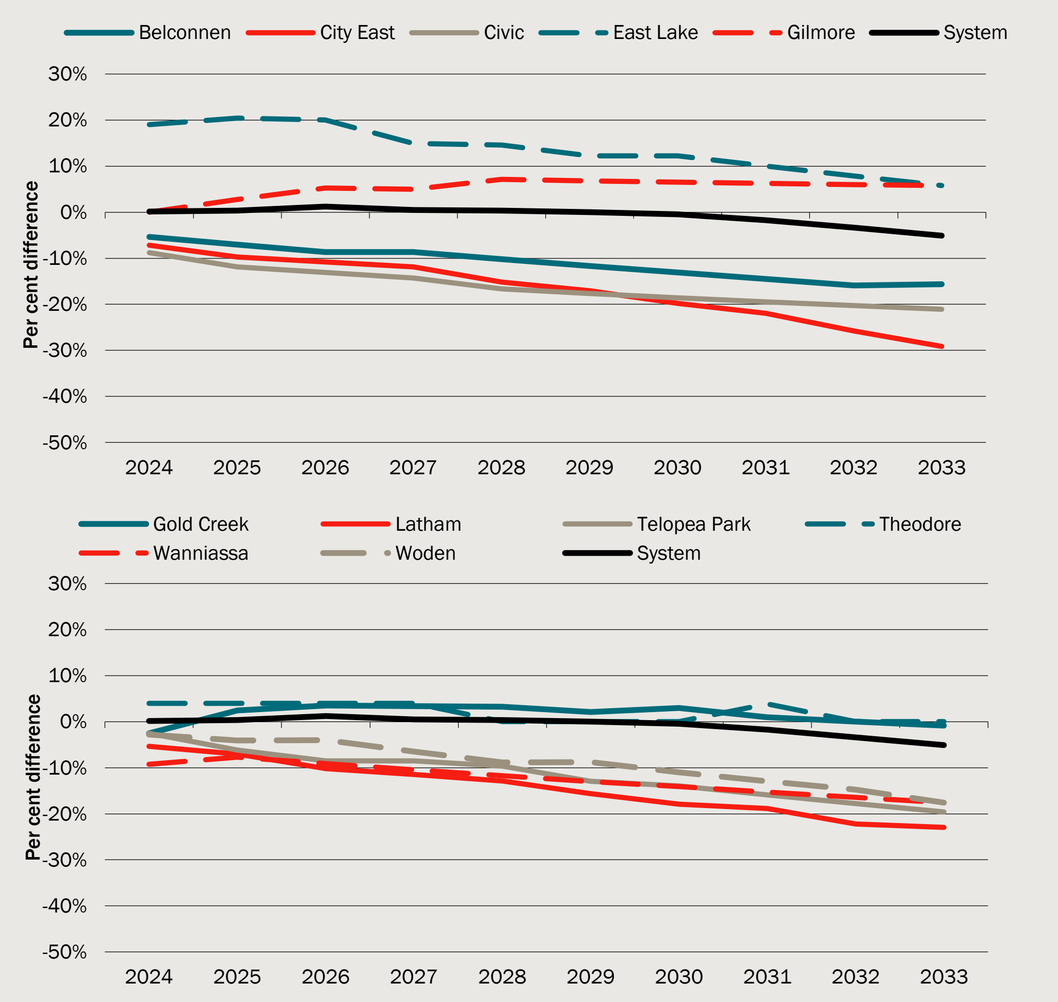
3.3 Revised forecast per cent difference from Jan 2023 forecasts – 50%POE Winter



Note: Dates are financial years; 2024 represents FY 2023/24. Positive per cent difference implies that the revised forecasts are higher than the January 2023 forecasts and vice versa.

Data source: Evoenergy.

3.4 Updated forecast per cent difference from Jan 2023 forecasts – 50%POE Summer



Note: Dates are financial years; 2024 represents FY 2023/24. Positive per cent difference implies that the revised forecasts are higher than the January 2023 forecasts and vice versa.

Data source: Evoenergy.

Assessment of the updated non-EV block loads methodology

Different approaches are taken for modelling at different network levels for block loads:

- system
- zone substation (all zone substations), and
- 11kV feeder (by exception).

Having different approaches for block loads and different spatial levels is a conceptually robust approach given the differences in what drives demand at different network levels.

Take the example of a zone substation servicing two feeders. To inform block loads at the feeder level requires more detailed information than for the zone substation, as the feeder block load adjustments require information on whether feeder 1 or 2 is impacted by some change in the future, while substation block loads are agnostic to this information.

Similarly, the sign of block loads at the feeder level may vary, such that the block load for feeder 1 could be positive (say in response to increased development), while the block load for feeder 2 could be negative (say due to the closure of a commercial customer). Again, the zone substation block loads are agnostic to this, and are only concerned with net change in demand affecting the substation.

A similar dynamic would be evident for system level forecasts relative to zone substation or feeder block loads. Given these differences it is appropriate to have different approaches.

The main change to the block load approach that Evoenergy has made in response to the AER's draft decision has been to add a "load inclusion criteria" to inform when block load adjustments should be incorporated into forecasts (table 3.5). The intent of this is to address the AER's comments around double counting in block loads, where block loads include growth which may be included in the historical patterns and estimated time trends. Essentially this approach seeks to avoid double counting where block loads may already be reflected in the statistical trend.

3.5 Load inclusion criteria

Load element	System forecast	Zone forecast	BAU feeder forecast	EV feeder forecast
Statistical trend	✓	✓	×	×
Residential connection	×	×	✓	✓
Mixed/commercial connection	◉	×	✓	✓
Industrial connection	◉	✓	✓	✓
Off-peak connection	◉	✓	✓	✓
Data centre connection	◉	✓	✓	✓
EV model	✓	✓	×	✓
Gas to electricity model	×	×	×	×

Note: ✓ Included; × Excluded; ◉ Inclusion by exception. "EV feeder forecast" is used for feeders where investment is driven by EVs, while "BAU feeder forecast" is used for non-EV driven feeders.

Source:

The key features of this approach are:

- Feeder forecasts exclude statistical trends, to avoid double counting of residential and mixed/commercial connections. In feeder planning the geographic location of load is important, which cannot effectively be forecast by trends. These block loads are included as they provide better information on the actual geographic location of new connections which are likely to drive investment for a specific feeder.
  - This approach avoids the issue around double counting of growth by excluding the trend, and uses information on the key driver (the geographical location of expected future load) of feeder investments
  - This is expected to result in relatively unbiased forecasts. However, it will exclude other factors which may affect demand and would otherwise be captured by a

  trend. For example, this would exclude energy efficiency improvements over time which reduce demand per dwelling, or increased energy demand which may occur as household incomes increase. Given new connections are the main driver of feeder capacity constraints, including block loads associated with growth is likely to be more important than including other drivers of growth
  - Note this approach is consistent with AEMO's connection point forecasting methodology which grows underlying demand by population growth.[6]
- Residential and mixed/commercial connections are excluded from zone substation forecasts to avoid double counting with the statistical trend.
  - Insofar as historical growth is a good predictor of future growth, this assumption should avoid double counting.
  - If actual future growth is stronger than over the history, this approach would understate demand, and vice versa. Overall, this is expected to be a conservative assumption for residential connections as for most zone substations, population growth is expected to be stronger than over the history (chart 3.6)
  - This approach will understate demand insofar as the statistical trend will include factors other than the change in the number of connections which affect demand (e.g. energy efficiency).
- Residential connections are excluded from system forecasts to avoid double counting with the statistical trend. Other loads are included by exception where the new load is unusual from a historical load perspective.
  - Insofar as historical growth is a good predictor of future growth, this assumption should avoid double counting.
  - If actual future growth is stronger than over the history (as is forecast for the ACT by the territory Government)[7], this approach would understate demand.
- Gas to electricity loads are not included in any of the forecasts
  - This is a very conservative approach and is likely to understate future demand at all network levels, as discussed further in the next chapter.

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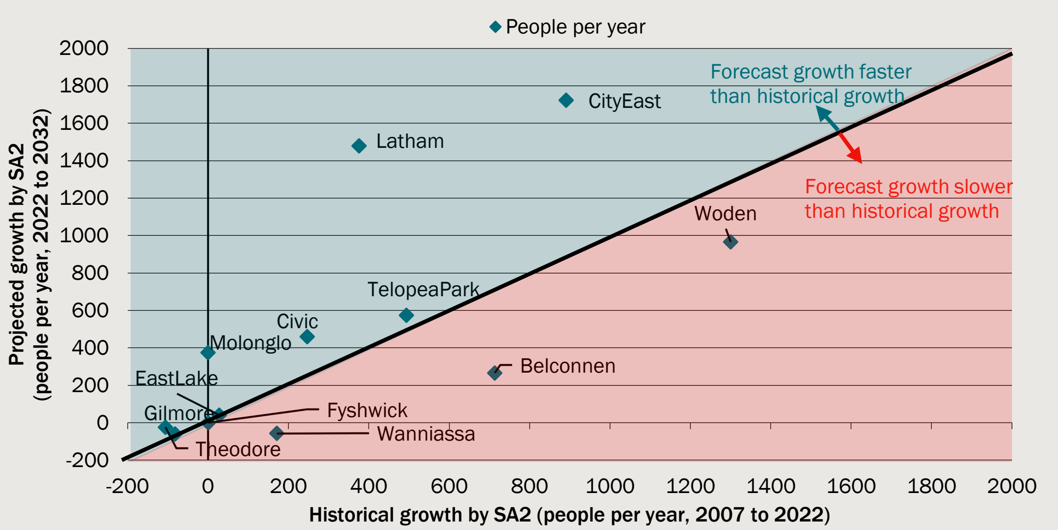
[6] AEMO 2021 Connection Point Forecasting Methodology, p. 22.

[7] https://www.treasury.act.gov.au/snapshot/demography/act

3.6 Historical and projected population growth for zone substations



Note: Gold Creek not shown as it has much higher growth than all other zone substations. Historical population growth is estimated at 3,567 people per year and forecast growth at 1,733 people per year.

Data source: ABS Regional Population Growth, Table 1. Estimated resident population, Statistical Areas Level 2, Australia; ACT Treasury Projections by SA2.

The changes Evoenergy has made in response to recommendations from the AER relating to non-EV block loads are summarised in table 3.7.

3.7 AER recommended considerations — non-EV blockloads

AER comment	Response
Block loads above the trend should be removed from the historical period and added to the forecast period to prevent duplications that have been captured within the trend component of the demand forecasts. This is to ensure only the demand impact driven by factors such as population, economic growth, energy prices, demand management, CER and energy efficiencies is carried to the forecast period as part of the trend projection	Not possible as historical block loads are uncertain. This has been resolved by Evoenergy for system and zone substation forecasts by excluding residential and mixed/commercial block loads.
Adjustments for block loads above the long trend should be observed for any trend estimated, regardless of whether the trend is estimated to be positive or negative. This is because the trend can result from an offset between the increasing demand from population and economic growth and the decline in the historical period due to other long-term demand drivers (for example, rising electricity prices, demand management, photovoltaic systems, battery storage and greater energy efficiencies)	Evoenergy has removed residential and mixed/commercial block loads.
Fundamentally it is population and economic growth that drives up electricity consumption and demand in the longer term. Evoenergy should take into account its historic understanding of the drivers affecting electricity demand to ensure the residential and commercial block loads only reflect the forecast above the trend	This is a sensible recommendation, although AEMO guidelines focus on population growth as the man driver. Evoenergy represents this in the system and zone substation forecasts in the trend. Feeder forecasts reflect this in the block loads (in the absence of a trend).

Evoenergy included a threshold of 0.5 MVA to identify large residential, commercial, or mixed development so that these large projects can be added to the block load forecast. However, this threshold is not consistently applied to prevent double counting in the baseline trend. Further, we require Evoenergy to provide its rationale for selecting 0.5 MVA as the threshold.	This arbitrary threshold has been removed, allowing blocks of any size to be included. Double counting has instead been addressed by the “Load inclusion criteria”.

Source: AER, 2023, *Draft Decision: Evoenergy Electricity Distribution Determination 2024 to 2029 (1 July 2024 to 30 June 2029)*, Attachment 5 Capital expenditure, p. 19;, CIE.

Assessment of the updated EV block loads methodology

Evoenergy’s modelling of EV block loads has been updated to incorporate the most up to date information for EV charging patterns (from AEMO), and for the expected uptake of EVs (from the ACT Government).

The changes to the modelling have consisted of:

- Estimating EV uptake to reflect the ACT Government’s projections based on the zero-emission vehicle sales target of 80-90 per cent by 2030 – as set out in the Zero Emissions Vehicles Strategy 2022-23. This was determined based on:
  - modelling for the Zero Emissions Vehicles Strategy 2022-23 undertaken by GHD and ACIL Allen assuming 80 per cent of new car sales at EVs by 2030.[8] This study gives the number of passenger EVs in the ACT in 2030 and 2045
  - these estimates are mapped to an annual profile using actual passenger EV uptake as a starting point
  - non-passenger EVs are estimated by applying the ratio of non-passenger vehicles to passenger vehicles for NSW, which was forecast by CSIRO for AEMO.[9] This step is required as the GHD and Acil Allen modelling prepared for the ACT Government only forecasts passenger vehicles.
  - EV uptake is then geographically disaggregated
    - for passenger vehicles using the distribution from a previous Deloitte Access Economics’ forecast undertaken for the ACT Government[10]
    - for commercial vehicles using the share of Evoenergy’s commercial customers across all of the ACT
    - for trucks using the share of commercial customers in commercial areas
- using EV charging profiles for NSW (forecasts were not prepared for the ACT) developed by CSIRO for AEMO to estimate the impact of EV uptake at various times of day.[11] This takes average load across different period of the day, weighted by the

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[8] GHD and ACIL Allen, 2023, *Technical and Economic Modelling of the ACT Electricity Network | Supplementary Report: Updated Electric Vehicles uptake*, prepared for the ACT Government Environment Planning and Sustainable Development Directorate.

[9] Graham, P., 2022, *Electric vehicle projections 2022*, Melbourne: CSIRO; csiro:EP2023-0235. https://doi.org/10.25919/3t1w-xv61.

[10] Deloitte Access Economics, 2021 [unpublished], prepared for the ACT Government.

[11] Graham, P., 2022, *Electric vehicle projections 2022*, Melbourne: CSIRO; csiro:EP2023-0235. https://doi.org/10.25919/3t1w-xv61.

estimated share of vehicle types on a given charging profile and share of vehicle type. Note this is based on the AEMO Progressive Change scenario. This gives the weighted average electricity demand by half hour block, by residential vehicles, commercial vehicles and trucks

- estimating peak demand by multiplying the charging load profile by vehicle numbers and a peak load factor (peak divided by diversified average).
  - It is assumed the addition to the peak will be 25 per cent higher than the average, based on a study prepared by Ergon Energy Network and Energex Network.[12] Note this study was undertaken for Queensland and included less than 200 customers in both peak and diversified peak estimates.
  - EV impacts are estimated overall (taking the peak across the entire day), daytime peak (from 10am to 2pm) and evening peak (from 4pm to 10pm).
  - These peaks are added as block loads to coincide with the timing of the peak before the block load was added.

These changes above are consistent with the changes recommended by the AER (see table 3.8). Evoenergy has taken the best available forecasts for EV uptake and undertaken simple data transformations to enable block loads to be estimated. To a large extent the accuracy of these forecasts will depend on the accuracy of the underlying inputs into the forecasts (noted above). Demand impacts on peak load could very well be higher if EV charging ends up being more variable than anticipated, for example.

3.8 AER recommended considerations — EV blockloads

AER comment	Response
For the zone substation peak demand, Evoenergy should take a more sophisticated assumption than winter evening peak for EV block loads to properly account for the various hourly load profiles for EV charging across zone substations which may have different peak times	Measures the peak at different times of day depending on when the peak occurs before the block load.
Evoenergy should continue to update its forecasts to reflect the latest inputs from AEMO	Has updated with an average of AEMO scenarios charging profiles prepared by CSIRO.
Provide greater transparency around the underlying assumptions applied for EV demand forecasts to inform the demand forecasting and augmentation capital expenditure assessment	Forecast are based on simple data transformations of reputable underlying forecasts.
Further revise the assumption on EV uptake (based on the updated ACT Government forecast) and charging profile on an energy per vehicle basis and zone substation peaking time.	EV forecasts have been updated based on the most recent ACT Government modelling of EV uptake, and AEMO commissioned modelling of EV charging loads prepared by CSIRO.

Source: AER, 2023, *Draft Decision: Evoenergy Electricity Distribution Determination 2024 to 2029 (1 July 2024 to 30 June 2029)*, Attachment 5 Capital expenditure, p. 17; CIE.

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[12] Ergon Energy Network and Energex Network, 2023, EV Smart Charge Queensland Insights Report. Which report a diversified peak of around 0.6 KW per vehicle against a peak of 0.75 KW per vehicle.

Comparison to other forecasts and internal consistency

Charts 3.9 and 3.10 compare Evoenergy's updated system forecast against:

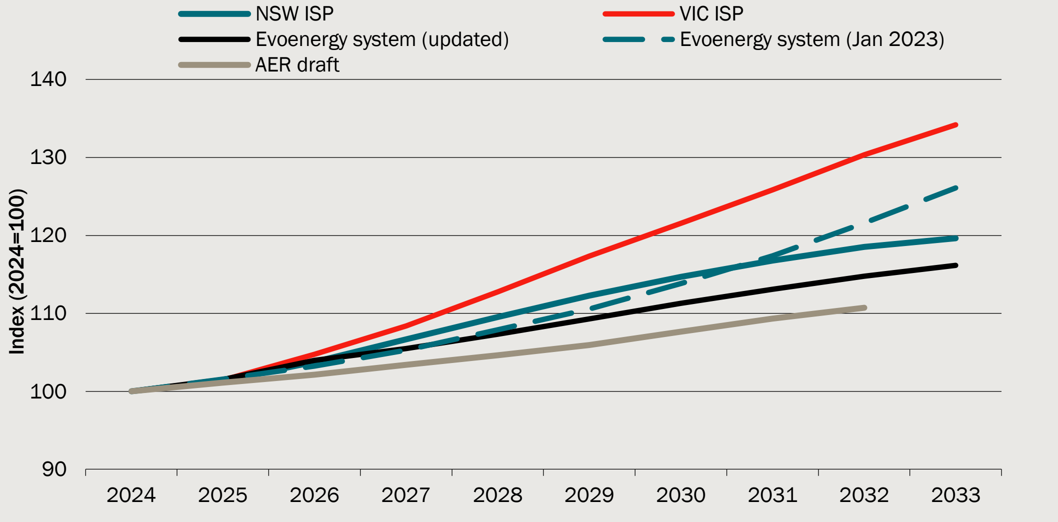
- NSW and Victoria ISP maximum demand forecasts prepared by AEMO. Note these forecasts are very similar to AEMO's ESOO 2023 forecasts
- Evoenergy's January 2023 forecasts
- AER's draft forecast for Evoenergy system (this is only shown for the winter forecast which drives the overall maximum).

Note that the NSW and Victorian ISP forecasts are not directly comparable to Evoenergy's forecasts as they cover different areas, however are included for illustrative purposes.

Based on these forecasts, we can make the following observations:

- Winter demand is expected to grow faster than summer demand across most forecasts, with the exception of the NSW ISP forecasts which expects similar growth across seasons to 2033
- Evoenergy's updated forecasts are lower than AEMO's forecasts for Victoria and NSW
- Evoenergy's January 2023 forecasts were broadly consistent with AEMO's summer forecasts for NSW and Victoria, and between NSW and Victorian forecasts for winter.
- AER's forecasts are considerably lower than other forecasts.

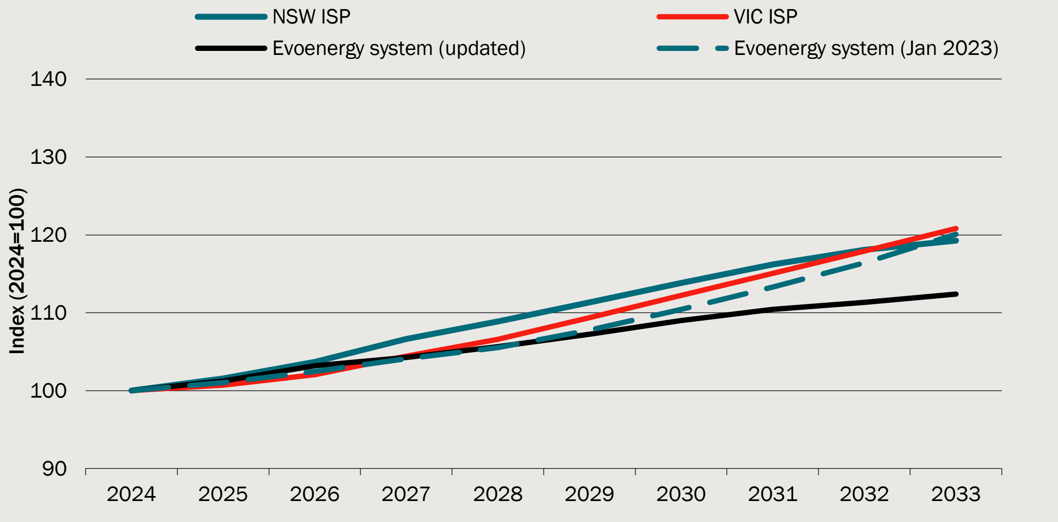
3.9 Winter maximum demand forecast comparison



Note: ISP forecasts are based on the "Step Change" scenario.

Data source: AEMO 2024 ISP forecasts, AER, Evoenergy.

3.10 Summer maximum demand forecast comparison



Note: ISP forecasts are based on the “Step Change” scenario.

Data source: AEMO 2024 ISP forecasts, AER, Evoenergy.

Lower maximum demand forecasts for Evoenergy could imply:

- Lower population growth for the ACT than NSW and Victoria
  - this is unlikely as population projections for the ACT expect population growth of 16 per cent from 2023/24 to 2032/33, compared to 15.6 per cent of Victoria and 9.9 per cent for NSW.[13]
- Slower gas to electricity switching for the ACT
  - this is unlikely given ACT has a gas ban similar to Victoria, however ACT may be more progressed in terms of appliance switching. NSW has lower levels of gas for heating.
- Slower uptake of EVs in the ACT compared to Victoria and NSW
  - this is unlikely give the ACT has more ambitious zero emission vehicle sales targets than NSW and Victoria[14] and current high rates of EV uptake in the ACT possibly driven by relatively high household incomes
- Lower economic growth in the ACT compared to Victora and NSW
  - there is limited information to take a view on this
- Changing peak to average demand ratio in Victoria and NSW
  - there is limited information to take a view on this
- Faster improvements in energy efficiency in the ACT
  - there is limited information to take a view on this.

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[13] Centre for Population, 2023, Population Statement 2022, state and territory projections, 2021-22 to 2032-33, accessed 27 October 2023, available here: https://population.gov.au/publications/statements/2022-population-statement.

[14] DCCEEW 2023, The National Electric Vehicle Strategy, Department of Climate Change, Energy, the Environment and Water, Canberra, appendix B.

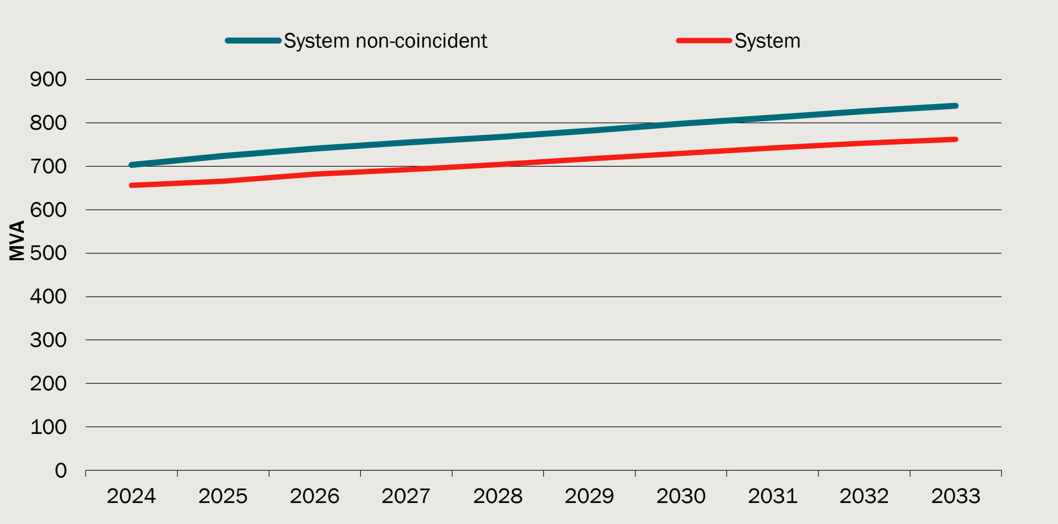
Reconciliation

Individual zone substation forecasts can be reconciled to the total system forecast, by taking the sum of zone substation maximum demand forecasts. This provides a way to verify that the forecasts are sensible and that the zone substation forecasts are not individually biased — generally we would expect that the ratio of system non-coincident demand (the sum of zone substation maximum demand forecasts) and system coincident demand (total system maximum demand forecast) to be relatively stable.

Charts 3.11 and 3.12 compares forecast system demand to the summation of zone substation demand. Because peak demand will occur at different times for different zone substations, the sum of peaks should be greater than the total system peak, which we observe across the modelling horizon.

Chart 3.13 shows the system coincident factor (coincident divided by non-coincident system forecasts). This shows the ratio remains relatively constant around 0.9 for both summer and winter over the forecast period. This suggests that Evo energy’s zone substation forecasts are internally consistent with the system forecasts. Note that this was not the case with Evoenergy’s January 2023 forecasts, where the sum of zone substation projections grew more rapid than system level projections.

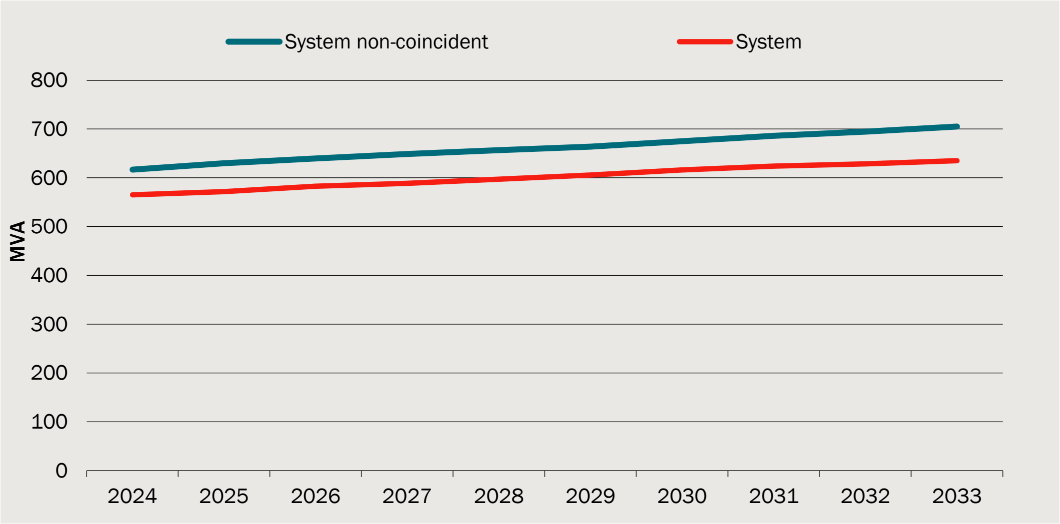
3.11 Winter 50% POE



Note: System non-coincident is the sum of Evoenergy zone substation forecasts.

Data source: Evoenergy

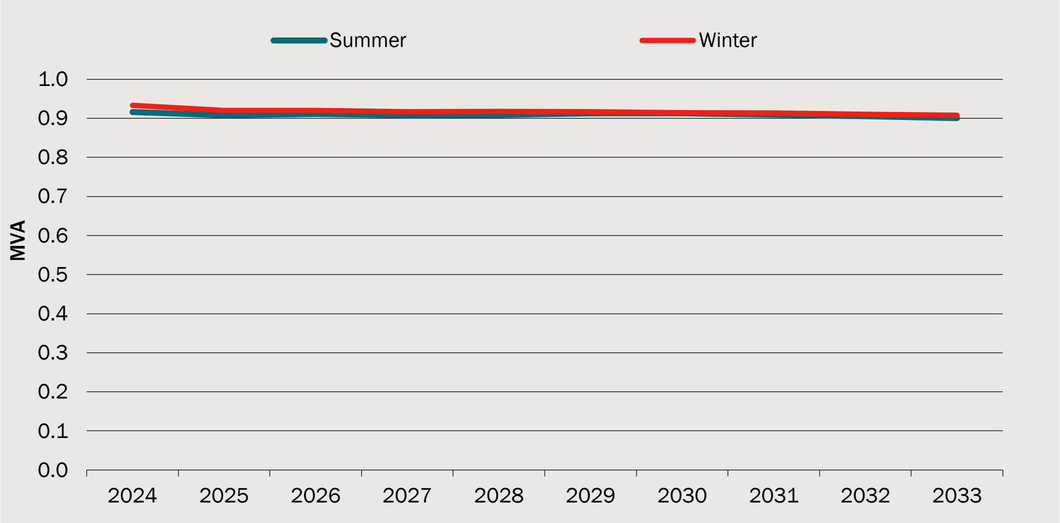
3.12 Summer 50% POE



Note: System non-coincident is the sum of Evoenergy zone substation forecasts.

Data source: Evoenergy

3.13 Evoenergy system coincident factor



Note: System non-coincident is the sum of Evoenergy zone substation forecasts.

Data source: Evoenergy

4 Potential biases in Evoenergy's revised forecasts

Forecasting demand for electricity is an inherently uncertain process and more so over the past decade with the significant policy and technology changes influencing electricity demand. In this chapter we consider whether there are specific issues that the forecasts are not taking into account, and the potential direction and magnitude of impacts. In particular, we consider:

- the starting point for forecasts — recent winter maxima have been well above the predicted maximum and the starting point for forecasts. It is likely that the 'off the line' approach being used is not picking up recent changes to demand and the starting point for demand is lower than reflected in recent data. This supports approaches that make adjustments to the forecasts to reflects factors like the level of uptake of electric vehicles and gas to energy substitution. These adjustments could be made to the starting point as well as to the forecast.
- gas to electricity conversion — ACT Government and Australian Government policies are much less favourable to the use of gas than electricity. New gas connections are to be banned in the ACT from late 2023,[15] while fossil fuel gas is planned to be entirely phased out in the ACT by 2045.[16] This is expected to lead to new dwellings consuming more electricity than would otherwise have been the case, as well as gradual switching from gas to electric appliances for existing households and businesses.

Starting point

Maximum demand is a probabilistic concept. As such, there is no direct observation of the starting PoE levels for a maximum demand forecast. Instead, the starting point has to be estimated. There are two approaches used for estimating the starting point:

- forecasting off the line — this uses the estimated regression line from a statistical model over a number of years to determine the predicted PoE levels for the most recent year. This is then used as the starting point for the forecast
- forecasting off the point — this uses the most recent year's (or 2-3 years) data only and makes a starting point using the weather relationships in this data and historical weather variability

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[15] See: https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/rattenbury/2023/act-reaches-milestone-preventing-new-fossil-fuel-gas-connections.

[16] See: https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/barr/2022/powering-canberra-our-pathway-to-electrification.

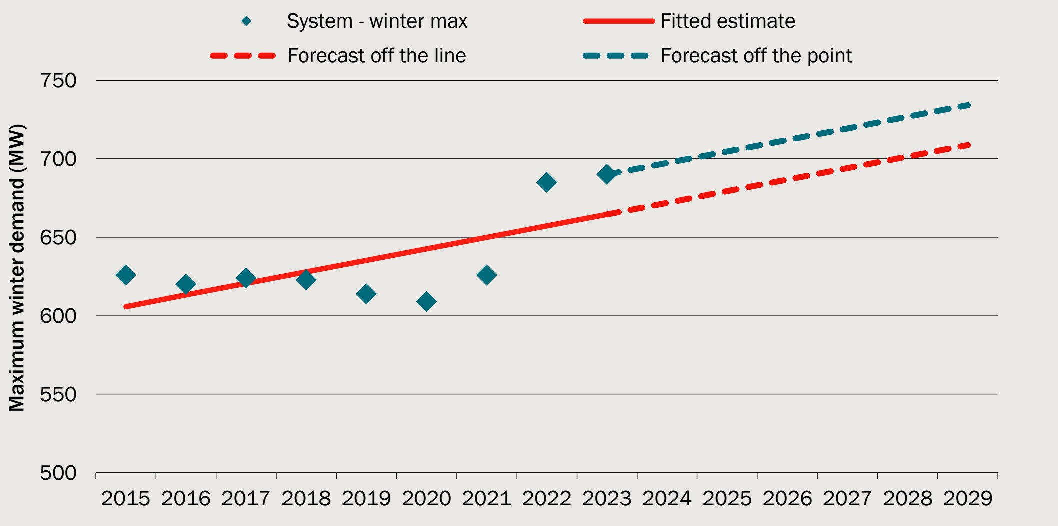
- i.e. if actual maximum demand observed was 100 in summer but the weather was unusually hot, then the PoE 50% would tend to be reduced say to 97.

The advantage of forecasting ‘off the line’ is that it uses more data and if the recent observed data is randomly higher or lower then it will not place as much weight on this. The disadvantage is that where there are changes in demand in recent years from drivers that are not well captured in the demand model then this will not be picked up. Hence when these methods give very different starting points, whether ‘off the line’ or ‘off the point’ is preferred will largely reflect a judgement about the extent to which recent outcomes have diverged systematically, or whether these simply reflect random variation.

Evoenergy uses an ‘off the line’ approach in its forecasting for maximum demand for the system and zone substations. AEMO uses an ‘off the point’ approach in its transmission connection point forecasts.

Evoenergy’s approach will tend to miss recent changes in maximum demand, which have been particularly prominent for winter. A simple example is shown in chart 4.1 using a linear regression fitted line to history for the overall winter system forecasts and no weather correction. If the recent winter outcomes actually reflect systematic changes to demand, then the ‘off the line’ approach will tend to start too low.

4.1 Different starting points from AEMO and Evoenergy approaches

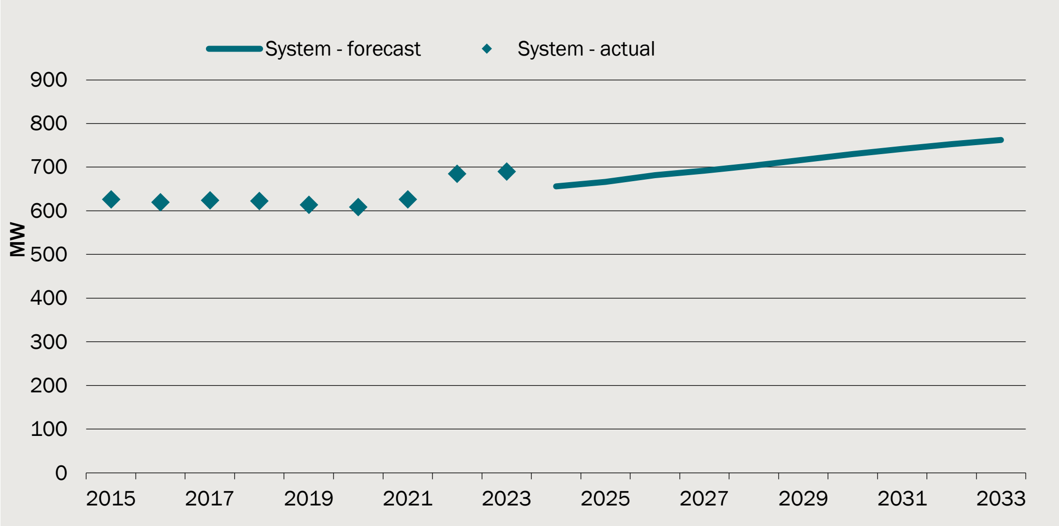


Note: Assuming no weather correction required to maximum demand in latest year for simplicity.

Data source: The CIE.

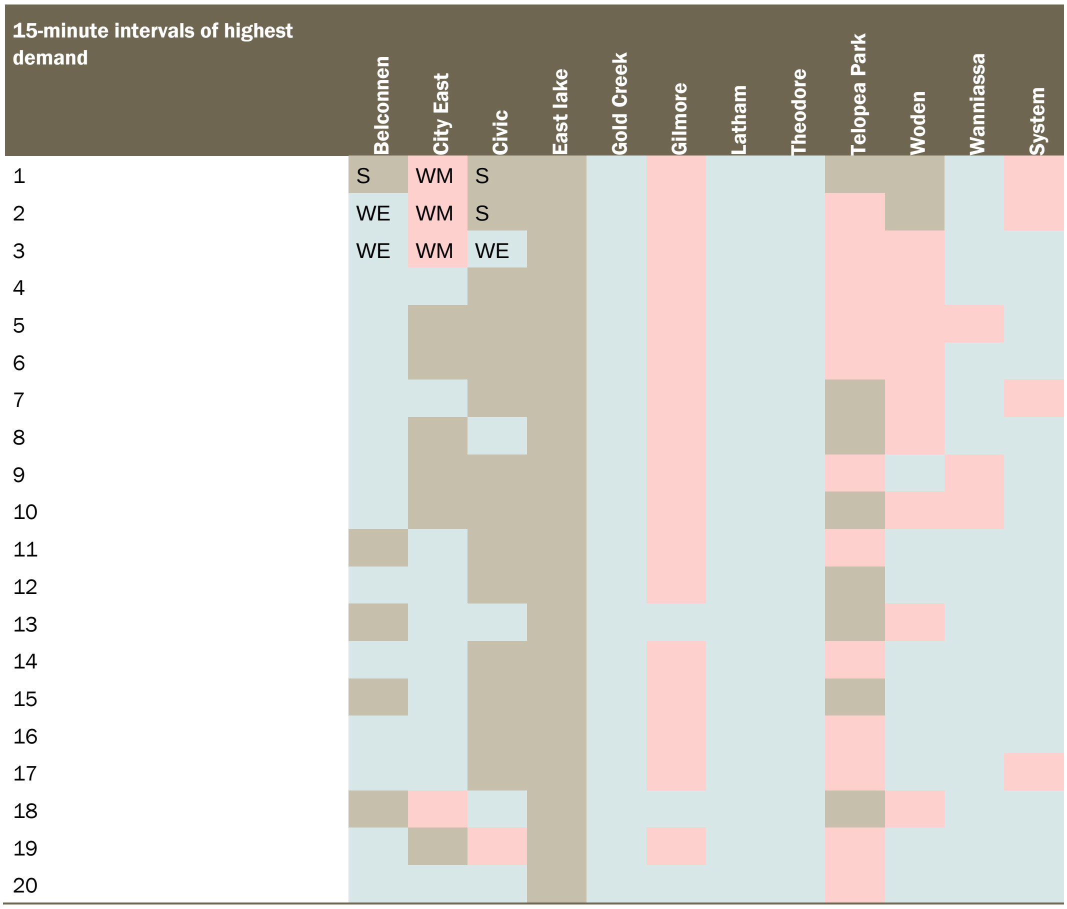
Evoenergy’s updated starting point for 2023 is relatively low compared to actual outcomes for 2022 and 2023 winter (chart 4.2). This is also true across most zone substations. This will impact on the maximum demand forecasts because most zone substations and the system as a whole are peaking in winter, sometimes in the morning and sometimes in the evening — table 4.3 shows the 20 highest periods of demand from 2019 to 2023 for each zone substation, with light blue showing winter evening (WE) and pink winter morning (WM). Only a small selection of substations had peaks during summer (S), shown in brown, such as Civic and East Lake.

4.2 Evoenergy revised system forecast and historical maxima



Data source: The CIE, based on data provided by Evoenergy.

4.3 Timing of highest twenty 15-minute periods of demand from 2019 to 2023



15-minute intervals of highest demand	Belconnen	City East	Civic	East lake	Gold Creek	Gilmore	Latham	Theodore	Telopea Park	Woden	Wanniassa	System
1	S	WM	S	🟫	🟦	🟥	🟦	🟦	🟫	🟫	🟦	🟥
2	WE	WM	S	🟫	🟦	🟥	🟦	🟦	🟥	🟫	🟦	🟥
3	WE	WM	WE	🟫	🟦	🟥	🟦	🟦	🟥	🟥	🟦	🟦
4	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟥	🟦	🟦
5	🟦	🟫	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟥	🟥	🟦
6	🟦	🟫	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟥	🟦	🟦
7	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟫	🟥	🟦	🟥
8	🟦	🟫	🟦	🟫	🟦	🟥	🟦	🟦	🟫	🟥	🟦	🟦
9	🟦	🟫	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟥	🟦
10	🟦	🟫	🟫	🟫	🟦	🟥	🟦	🟦	🟫	🟥	🟥	🟦
11	🟫	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟦	🟦
12	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟫	🟦	🟦	🟦
13	🟫	🟦	🟦	🟫	🟦	🟦	🟦	🟦	🟫	🟥	🟦	🟦
14	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟦	🟦
15	🟫	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟫	🟦	🟦	🟦
16	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟦	🟦
17	🟦	🟦	🟫	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟦	🟥
18	🟫	🟥	🟦	🟫	🟦	🟦	🟦	🟦	🟫	🟥	🟦	🟦
19	🟦	🟫	🟥	🟫	🟦	🟥	🟦	🟦	🟥	🟦	🟦	🟦
20	🟦	🟦	🟦	🟫	🟦	🟦	🟦	🟦	🟥	🟦	🟦	🟦

Note: Light blue is Winter Evening (WE); Pink is Winter Morning (WM); Brown is summer (S). Summer peaks tended to be early in the period (2020) and winter peaks in 2022 and 2023.

Source: The CIE based on data provided by Evoenergy.

It is evident that the higher winter demand in the past two years is relatively systematic rather than being related to a single day or 15-minute period of high demand (table 4.4).

- The overall system PoE 50 per cent forecast for 2023 is 643 MW. There were 8 days in 2023 above that forecast, with a max of 689.8MW.
- All the zone substations except for Gold Creek had at least one day with a maximum about the 50% PoE starting point in 2023.
- Four zone substations had at least one day with a maximum about the 10% PoE starting point.

This suggests that the starting points in 2023 for the forecasts are likely to be somewhat conservative. This is not surprising if there have been factors that are starting to lead to increasing winter demand that are not well accounted for in the underlying forecast model. These could include:

- switching of gas heating to electric heating — discussed in the next section
- take up of electric vehicles — discussed earlier. Adjusting for the level of current uptake, rather than just the incremental uptake would be appropriate in this case
- other changes in demand drivers, such as solar PV, behind the meter batteries, energy efficiency, prices of energy and incomes, and how they impact on demand.

4.4 Starting point for revised Evoenergy forecasts, winter

	PoE 50%	PoE 10%	Number of days above PoE 50% 2023	Number of days above PoE 10% 2023	Max winter in 2023	% difference to 50% PoE
	MW	MW	No.	No.	MW	Per cent
ABCN-Belconnen	58	61	4	0	59.7	3.0%
ACTE-City East	70	75	9	1	76.1	8.7%
ACVC-Civic	52	55	1	0	53.7	3.2%
AELK-East Lake	16	19	6	0	16.7	4.2%
AGCK-Gold Creek	87	91	0	0	85.2	-2.1%
AGLM-Gilmore	36	38	9	0	37.8	5.1%
ALTM-Latham	70	75	5	0	73.5	5.0%
ATDR-Theodore	29	30	2	1	30.2	4.0%
ATLP-Telopea Park	82	87	1	0	84.2	2.7%
AWDN-Woden	83	88	4	2	90.1	8.6%
AWSA-Wanniassa	75	82	8	1	82.2	9.5%
System	643	676	8	2	689.8	7.3%

Source: The CIE, based on data provided by Evoenergy.

Gas to electricity conversion

As noted above, it is likely that the starting point for forecasts does not fully capture any impacts of gas to electricity substitution to date. The revised projections also do not seek to include changes in electricity demand arising from people changing their use of gas and using electricity instead.

There are a range of sources that expect some level of gas to electricity substitution in Evoenergy's network.

- AEMO's projections of maximum electricity demand for NSW and Victoria allows for increasing demand in response to gas to electricity. By 2030, under the central scenario, it expects winter demand to be 6 per cent higher in NSW and 9 per cent higher in Victoria because of electrification than would otherwise be the case (table 4.6)
- The ACT's policies are actively seeking to switch people's energy use from gas to electricity, through loans, rebates and incentives, partnered with education, and intended regulations around new homes not being able to connect to gas.[17]
- Gas usage data for Evoenergy's gas distribution network. This shows declining gas use for winter peaks over time (chart 4.5). From 2015 to 2022, total winter gas receipts for the ACT and Queanbeyan have fallen by 15 per cent, while non-winter has increased by 6 per cent over the same period. This suggests that the type of appliance switching happening is most likely heating related. This means that the impact of gas switching will show up particularly in peak winter demand for electricity, as this is where gas use is highest and where usage has fallen the most (chart 4.5).
- Evoenergy's gas demand forecasts allow for some level of declining demand in response to gas electricity to substitution, based on ACT Government rebates. By 2026, this is a 2.8 per cent decline in gas usage.[18]

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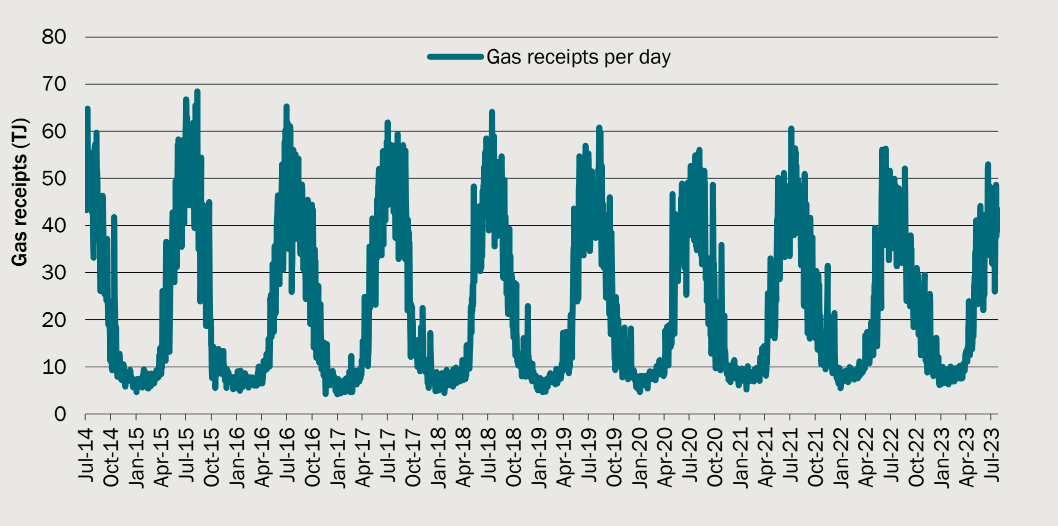
[17] ACT Government 2023, ACT Integrated Energy Plan, https://hdp-au-prod-app-act-yoursay-files.s3.ap-southeast-2.amazonaws.com/9716/9078/0794/Integrated_Energy_Plan_Position_Paper_ACCESS_FA.pdf.

[18] The CIE 2020, Appendix 7.1 Demand forecasting report Access arrangement information ACT and Queanbeyan-Palerang gas network 2021–26 Submission to the Australian Energy Regulator, Table 6.17, https://www.aer.gov.au/system/files/Evoenergy%20-%20CIE%20-%20Appendix%207.1%20-%20Demand%20forecasting%20report%20-%20June%202020%20-%20CORRECT.pdf.

4.5 Profile of gas use across the year ACT and Queanbeyan



Data source: Evoenergy.

4.6 AEMO ESOO expected impact of electrification

Year	NSW		Victoria	
	Summer	Winter	Summer	Winter
	Per cent	Per cent	Per cent	Per cent
2024	0.4	0.4	0.2	0.3
2025	1.0	1.1	0.4	1.0
2026	2.0	2.3	0.7	2.3
2027	3.3	3.9	1.0	4.0
2028	4.2	5.1	1.3	6.1
2029	4.8	6.0	1.6	7.9
2030	4.9	6.3	1.7	9.0
2031	5.0	6.6	1.8	10.2
2032	5.0	6.7	2.1	11.7
2033	5.0	6.9	2.3	12.9
2034	4.9	7.0	2.9	14.8

Note: For the central scenario and 50% PoE.

Source: AEMO ESOO 2023 maximum demand forecasts, Forecasting portal, https://forecasting.aemo.com.au/Electricity/MaximumDemand/Operational.

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