**Department**

Gold Coast campus
Griffith University, Queensland 4222
Australia

griffith.edu.au

# 2024 Electricity Demand Forecasting Methodology Consultation

**Submission to AEMO, 23 August 2024**

The Centre for Applied Energy Economics and Policy Research (CAEEPR) is a collaborative partnership between Griffith Business School and energy sector participants in Australia's National Electricity Market.

CAEEPR aim to maximise the energy sector's potential to achieve emission reductions and contribute to inclusive, sustainable, and prosperous businesses and communities while building capacity in electricity economics. CAEEPR uses a national electricity market model to develop and analyse different scenarios to assess different policy positions for generator dispatch and transmission efficiency.

CAEEPR's sub aims/objectives that are most relevant to this submission:

- Supporting the transition to more sustainable and less carbon-intensive power generation and transmission system and address the accompanying policy, economic, technical and political challenges within the industry.
- Provide thought leadership and industry engagement strategies that our members can design and deliver best practice energy services with reduced emissions.
- Create and uphold advanced Electricity Market models for analyzing wholesale spot and future markets, power system reliability, integration of dispatchable and intermittent resources, and network capacity adequacy.

This submission has been prepared by Andrew Fletcher and Huyen Nguyen, who are Industry Adjunct Research Fellows at CAEEPR. The views expressed in this submission are entirely the authors' and are not reflective of CAEEPR.

For further information contact:

Andrew Fletcher | Adjunct Industry Research Fellow

Centre for Applied Energy Economics and Policy Research (CAEEPR) | Griffith Business School

Griffith University | South Bank campus | QLD 4101

andrew.fletcher@griffith.edu.au

## Background

AEMO's Forecasting Approach sets out the various components that contribute to the forecast of electricity demand and consumption critical to AEMO's NEM forecasting and planning publications, including the reliability forecast. The forecasting review is conducted every four years. Two categories of changes are provided for consultation:

- Proposed changes, where AEMO has a specific proposal for how it is seeking to amend the methodology in the second stage of the consultation.
- Potential changes, where AEMO has noted that the existing methodology may need to be revised, but has not yet formed a specific approach that it seeking feedback on at this time

## Responses to Consultation Questions

1. **Does a component-based forecasting approach continue to provide a fit-for-purpose method that reflects best practice for electricity demand forecasting?**

Component based forecasting is supported. It allows for compartmentalisation of drivers and the potential for improvement of input assumptions and modelling methodologies to increase alignment with least-cost decarbonisation.

*Section 1.3 Demand drivers, uncertainty and risks* of Forecasting Approach - Electricty Demand Forecasting Methodology (AEMO, 2023A) lists a range of structural drivers. It is recommended that decarbonisation policy is included as a key driver, as it drives fuel switching in transport (e.g. vehicle efficiency standards) and industry (e.g. emission reduction targets/budgets) that represent most of the load growth in the ISP.

*Section 1.3* also does not mention that much of the long-term demand growth, particularly for large industrial loads, is sourced from the CSIRO/Climateworks Multi-sector Report (CSIRO & Climateworks Centre, 2022). In the August 2023 Electricity Demand Forecasting Methodology report, it is only mentioned in passing that "Electrification is based on the forecasts outlined in the IASR" (p.57) and only in the IASR report is it explained that this electrification load comes from the CSIRO multi-sector AusTIMES model. Given the linkages between these three reports (and many other input consultant reports), a diagram of their relationships would help the reader navigate through them.

AEMO's forecasting principles include "transparency – to ensure inputs and forecast methodologies are well understood". It is crucial for stakeholders to have a good understanding of the CSIRO/Climateworks multi-sector model and other consultant input models to the AEMO ISP. These input models as well as the mesoscale modelling that is used to produce wind generation traces are complex and subject to potential biases and errors. Outputs from these complex models are then used as inputs to the arguably more complex ISP models, increasing the risk of compounding errors.

The authors of this submission (Andrew Fletcher and Huyen Nguyen) highlighted in their Draft 2024 ISP Consultation Submission that a key methodological issue with the multi-sector model is a lack of time-sequential modelling and that this could be driving an overestimate of green hydrogen demand. This flaw could also result in an underestimate of the cost of industrial electrification and overestimate the speed of uptake. We welcome AEMO's efforts to review the use of the multi-sector model. We also encourage AEMO to acknowledge within the methodology that potential model biases and errors in inputs model could be a feature of its demand forecasting. This could help stakeholders understand inherent risks around ISP modelling as well as why AEMO strives to improve its modelling.

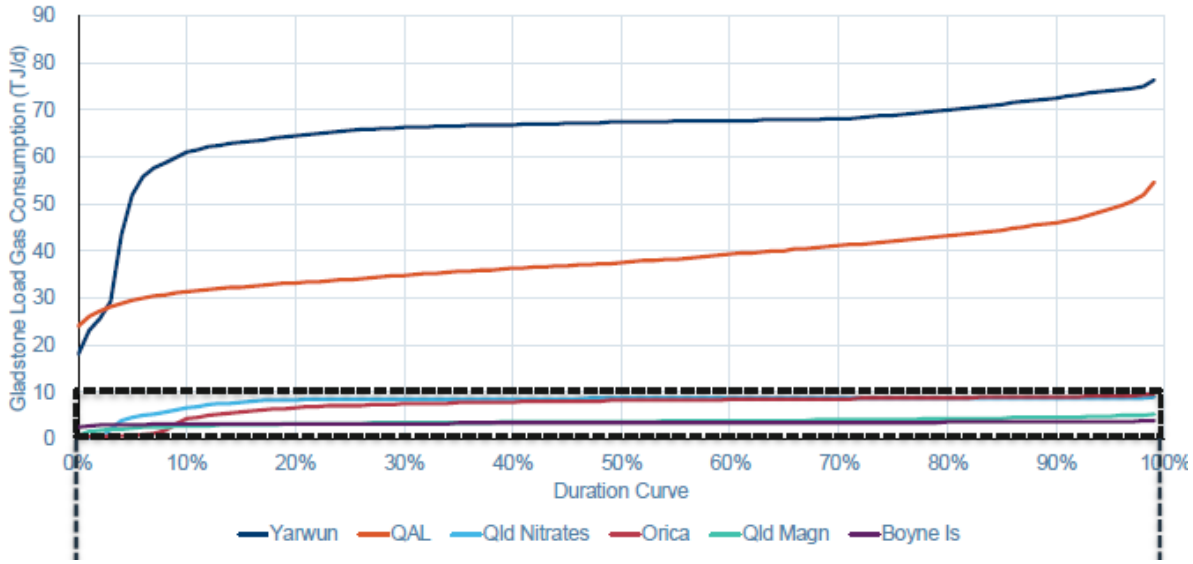
2. **Are the customer segments appropriate aggregations of electricity consumers, and do they provide sufficient capability to apply aggregate methodologies for each in order to forecast each cohort's future electricity consumption?**

In Chapter 6 of the Electricity Demand Forecasting Methodology report, AEMO states that “New electrified loads are *assumed to mirror existing electricity temporal consumption patterns*, generally with more load in the day than overnight. The business electrification load is dominated by larger sites and *is assumed to be flat* across the year and across the day as large industrial loads electrify their processes. The residential load profile varies across the day and is much higher in winter compared to summer due to heating load” (p.57). However, future electrified loads are likely to exhibit different temporal patterns from existing ones to adapt to variable renewable energy as opposed to current fuel supplies. Hence, the disaggregation of loads is important as there might be material differences in customer behaviour and demand flexibility.

There is significant uncertainty around the timing and magnitude of industrial decarbonisation load growth (electrification and hydrogen) and the flexibility of this potential load. In addition to current practice of disaggregating LNG producers, export hydrogen and domestic hydrogen, large industrial loads are recommended to be further disaggregated into key major industries where current or future forecast load is material and flexibility input assumptions are or may become available in the future.

- Aluminium smelters – The capacity of aluminium smelters is publicly available. The limited flexibility and demand response capability of Australian aluminium smelters is reasonably well understood within industry. Due to different pot types the potential demand response capability of Australian aluminium smelters may be less than the recently announced New Zealand Aluminium Smelter Demand Response agreement (Rio Tinto, 2024), which is for up to a third of load.
- Future decarbonised alumina refineries
    - The large contribution of Queensland alumina refineries to forecast load growth was acknowledged in a recent AEMO Forecasting Reference Group presentation. The decarbonisation of alumina refineries including flexible operation enabled by thermal energy storage was discussed in the authors Draft 2024 ISP Consultation Submission and is an area of active research for industry including the Heavy Industry Low-carbon Transition Cooperative Research Centre (HILT CRC, 2023).
    - Figure 1 (Stabler, 2024) shows that existing daily gas usage in Yarwun and QAL has a degree of variability, which suggests that if alumina refineries are directly or indirectly electrified (green hydrogen), demand flexibility could be materially higher than aluminium smelters.
    - There is also significant uncertainty around decarbonisation of alumina calcination with the 2023 CSIRO Pathways to Net Zero Emissions study assuming limited hydrogen substitution (CSIRO, 2023). We seek clarification on whether this is consistent with the CSIRO/Climateworks multi-sector model output. In practice, hydrogen calcination is being trialled at Yarwun and renewable power electric calcination at Alcoa. The outcome of these pilot projects could inform future modelling assumptions.

Figure 1 Gladstone Gas Consumption (TJ/d) - Ranked Duration Curve



Source: The Edge 199 – Energy Market Update (Stabler, 2024)

- Hydrogen – Per the authors' Draft 2024 ISP Consultation submission, more granular hydrogen demand traces should be provided including a split of domestic demand between industries. This is recommended given different marginal abatement cost for using hydrogen in these industries and different potential for demand flexibility. Domestic demand is recommended to be split at a minimum between transport, green ammonia, green fuels (methanol and e-fuels), green iron, alumina calcination and cement. This split is on the assumption that ISP consultant input models forecast such hydrogen demand eventuating.
- Other industrial heat – Whether a large industrial load, or a business mass market load, splitting electrification into low, medium and high temperature heat is recommended. While electrified low-temperature heat could be dominated by heat pumps running continuously, medium and high temperature could integrate thermal energy storage and potentially genuine process flexibility. The Race for 2030's Electrification and Renewables to Displace Fossil Fuel Process Heating report is a good source of information on industrial heat demand (Race for 2030, 2021).
- Data centres - Please see response to question 7.

It is noted in the Electricity Demand Forecasting Methodology that "The electrification component only captures the energy needed to perform the activities previously performed by alternative fuels, with inherent fuel-conversion efficiency gains as appropriate". This wording is confusing because it implies a switch from ICE to EV would also be included. We recommend a more explicit wording such as "heating activities".

Several industries can either be directly electrified, adopt hydrogen or utilise CCUS. AEMO should explain how the electrification and hydrogen forecasts are internally consistent within each scenario.

In the BMM section, AEMO states that "Annual electricity consumption arising from these electrification activities will be based on consultancy inputs and added to the overall BMM forecast". It is recommended that AEMO be explicit about which consultancy report this component comes from.

**6. Are there any other changes that AEMO should consider to the methodology for developing hydrogen forecasts, beyond expanding its use into other green commodities?**

The authors' Draft 2024 ISP Consultation Submission discussed in detail methodological issues with AEMO's hydrogen forecasting methodology and provided detailed recommendations. Please refer to this submission.

**7. Should AEMO create a separate customer segmentation for data centres, removing them from the LIL and BMM segments? Would the preferred approach apply a survey driven forecast, observations from international trends or another technique?**

A separate customer segmentation for data centres is recommended. There is significant uncertainty regarding the rate of load growth from data centres, particularly load growth driven by AI. There is also significant uncertainty around potential behaviour (demand flexibility) of new data centres, particularly those focussed on AI. AEMO is encouraged to seek a range of views on data centre load growth and demand flexibility and also review publicly available literature from independent sources that could have different viewpoints than data centre proponents and DNSPs. For instance, AEMO could commission a consultant or researchers to undertake an independent academic and industry literature review on data centre load growth and demand flexibility.

**12. Do you have any comments on AEMO's potential improvements to developing demand traces?**

Disaggregating demand traces between Large Industrial Load and non-Large Industrial Load components when scaling the traces is supported.

We recommend that AEMO make the scaling algorithm publicly available for stakeholders to examine the methodology.

**16. Do stakeholders consider that the current collection of methodologies, published by AEMO and/or its consultants, provide sufficient transparency on its approach to forecasting PV, battery and VPP uptake and operation?**

The Green Energy Markets report for forecasting PV and battery uptake includes public subsidies for half of upfront battery cost, a key assumption not frequently mentioned. Whether there is interdependency between PV and battery uptake, particularly in the Green Energy Markets Report is not clear. A LinkedIn article from Green Energy Markets (Edis, 2024) appears to draw a direct link between solar PV and battery installs in the Green Energy Market payback model. We seek clarification on this link as we note that the forecasts (as presented at the Draft 2024 electricity consumption forecasts for the 2024 ESOO FRG in May) have changed significantly.

## References


AEMO. (2023A). *Forecasting Approach - Electricty Demand Forecasting Methodology.* Retrieved from https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2024/2024-electricity-demand-forecasting-methodology-consultation/electricity-demand-forecasting-methodology.pdf?la=en

CSIRO & Climateworks Centre. (2022). *Multi-sector energy modelling 2022: Methodology and results.* Retrieved from https://publications.csiro.au/publications/publication/PIcsiro:EP2022-5553#:~:text=AEMO%20commissioned%20CSIRO%20and%20Climateworks,%2D22%20to%202053%2D54

CSIRO. (2023). *Pathways to Net Zero Emissions –An Australian Perspective on Rapid Decarbonisation.*

Edis, T. (2024, February 21). *Four reasons why rooftop solar will grow to dominate the electricity market.* Retrieved from linkedIn: https://www.linkedin.com/pulse/four-reasons-why-rooftop-solar-grow-dominate-electricity-tristan-edis-lbl9c/

HILT CRC. (2023). *Evaluation of Thermal Storage and MVR use to allow variable renewable input for steam in alumina production.* Retrieved from https://hiltcrc.com.au/projects/program01-rp1002/

Nguyen, H., & Fletcher, A. (2024). *Draft 2024 ISP Consultation Submission.* Retrieved from https://www.griffith.edu.au/__data/assets/pdf_file/0019/1932220/No.2024-02-Draft-2024-ISP-Consultation-Submission.pdf

Race for 2030. (2021). *Electrification and Renewables to Displace Fossil Fuel Process Heating Report.* Retrieved from https://racefor2030.com.au/project/electrification-and-renewables-to-displace-fossil-fuel-process-heating/

Rio Tinto. (2024, May 31). *Long-term future for New Zealand's Tiwai Point aluminium smelter secured with new power deals*. Retrieved from https://www.riotinto.com/en/news/releases/2024/long-term-future-for-new-zealands-tiwai-point-aluminium-smelter-secured-with-new-power-deals

Stabler, J. (2024). *The Edge 199 – Energy Market Update.* Energy Edge.