Department of Energy and Economic Diversification

GOVERNMENT OF WESTERN AUSTRALIA

Energy Policy WA

Improving visibility for operational forecasting in the WEM

Open consultation

13 August 2025

EPWA and Frontier Economics

Working together for a **brighter** energy future.

Welcome

Please place your microphone on mute, unless you are asking a question or making a comment.

- **Please keep questions relevant to the agenda item being discussed.**
- **If there is no break in discussion and you would like to say something, you can 'raise your hand' by typing 'question' or 'comment' in the meeting chat. Questions and comments can also be emailed to energymarkets@deed.wa.gov.au after the meeting.**
- **If you are having connection/bandwidth issues, you may want to disable the incoming and/or outgoing video.**

Agenda

10.00am	Welcome and Overview
10.10am	Background Analysis
10.25am	Proposal 1 - Reconsider blending parameters
10:30am	Proposal 2 - Increase collaboration with a number of weather data providers
10:35am	Proposal 3 - Enhance documentation and processes
10:40am	Proposal 4 - Introduce a centralised forecasting approach for intermittent generation
11:10am	Proposal 5 - Publish operational forecasting metrics
11:15am	Proposal 6 - Formalise large load information provisions
11.25am	Next Steps

Improving visibility for operational forecasting in the WEM

EPWA / AEMO project

EPWA and AEMO are undertaking this project to investigate challenges to the accuracy of AEMO's operational forecasts, the impact of inaccuracy on WEM outcomes and how other markets are addressing similar issues.

The project has three stages:

Stage 1

- **Assess materiality of error:** Identify periods of inefficiency in WEM market outcomes that could reasonably be attributed to operational forecasting error, and identify the material sources of these errors.
- **Inter-jurisdictional review:** Compare WEM operational forecasting methods to other jurisdictions to understand how they address similar challenges

Stage 2

- **Identify gaps:** Identify gaps in existing WEM operational forecasting sources of information or tools from Stage 1 analysis

Stage 3

- **Recommendations:** To improve operational forecasting inputs, tools or methods and supporting rule changes if required

Purpose of today

Share key insights and outcomes

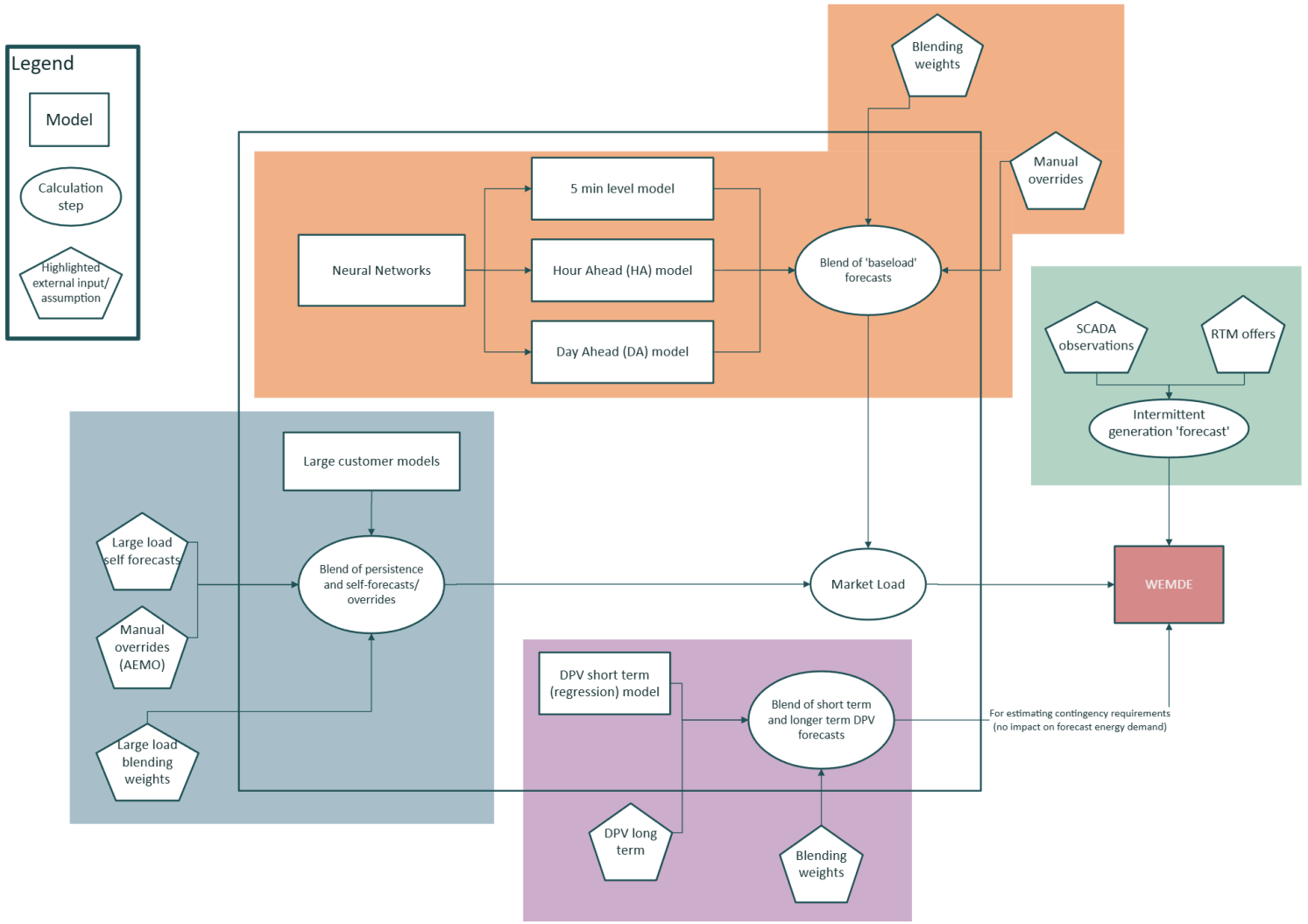
Stage 1 and 2 of the work program are complete – delivered by Frontier Economics, with inputs from AEMO and EPWA.

Stage 3 is in progress - Frontier Economics has developed proposals for reform which will be presented today.

The aim today is to share key insights/outcomes from Stage 1 and 2 and present reform proposals.

Input on reform proposals is being sought from TDOWG

Operational forecasting in the WEM



There are five key components to operational forecasting in the WEM

1. Metered ‘baseload’ demand represents the bulk of customer load; key inputs are recent trends and weather forecasts
2. Large load models represent significant loads; key inputs are recent trends and reported outages/activity
3. Intermittent generation forecasts indicate available unconstrained resource; based on persistence forecast blended with RTM offer
4. DPV forecasts:
   - Explicit forecast used for establishing contingency requirement
   - Impact of DPV forecast included in ‘baseload’ demand forecasts
5. WEMDE produces forecasts of market outcomes providing signals to the market

Sources of forecast error

Forecast error may arise within each of these components listed on the previous slide, and be attributable to:

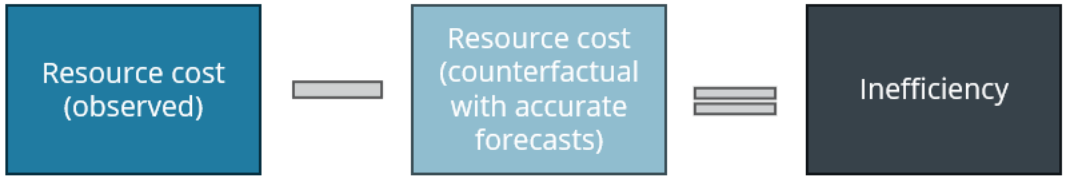
- **Input error:** e.g. the weather forecasts used in demand forecasts may be inaccurate.
- **Model misspecification:** e.g. irrelevant variables may be used, relevant variables may be omitted, or the functional form may be inappropriate.
- **Model implementation:** e.g. the model may be trained on out-of-date information, or trained on a very long horizon which masks recent trends.
- **Pre- and post-model calculations:** e.g. smoothing and blending processes may increase rather than decrease error.

Ultimately:

- **Given correct inputs, does the model accurately predict outcomes?**
- **Can the quality, frequency, and/or understanding of uncertainty of inputs be improved?**

Methodology to prioritise sources of error

Assessing inefficient market outcomes related to the sources of forecast error



This represents a complex task:

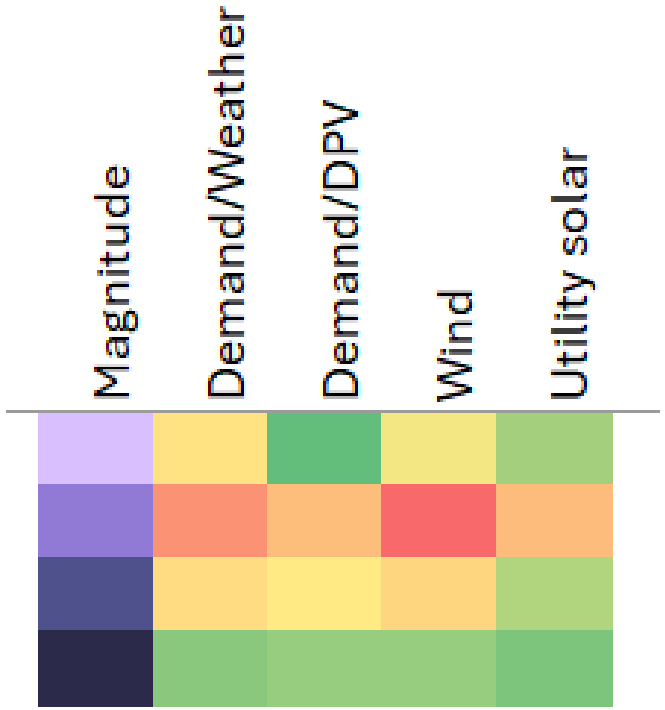
In a perfect world …
• For each component (and interactions), produce accurate forecasts; re-run WEMDE • Induce counterfactual actions (RTM offers) from participants based on new forecasts • Re-populate WEMDE with accurate forecasts and counterfactual actions • Compare counterfactual resource cost with observed resource cost

Our approach
• Produce detailed dashboard with daily market outcomes (forecasts, offers, dispatch, notices) • Qualitatively identify periods of inefficiency • Relate outcomes to source of forecast error, if possible • Qualitatively assess counterfactual outcomes

We note this is far from perfect; however, the approach provided a reasonable direction forward

Key findings

Assessing inefficient market outcomes that can be attributed to forecasting error



Ranking of material error impacting on market outcomes:

- Market outcomes are graded from least impact (light purple) to most impact (dark purple).
- For each level of impact, the frequency of events attributable to a source of forecast error is indicated by a colour scale ranging from green (least frequent) to red (most frequent).

Identifies the following priority areas in order:

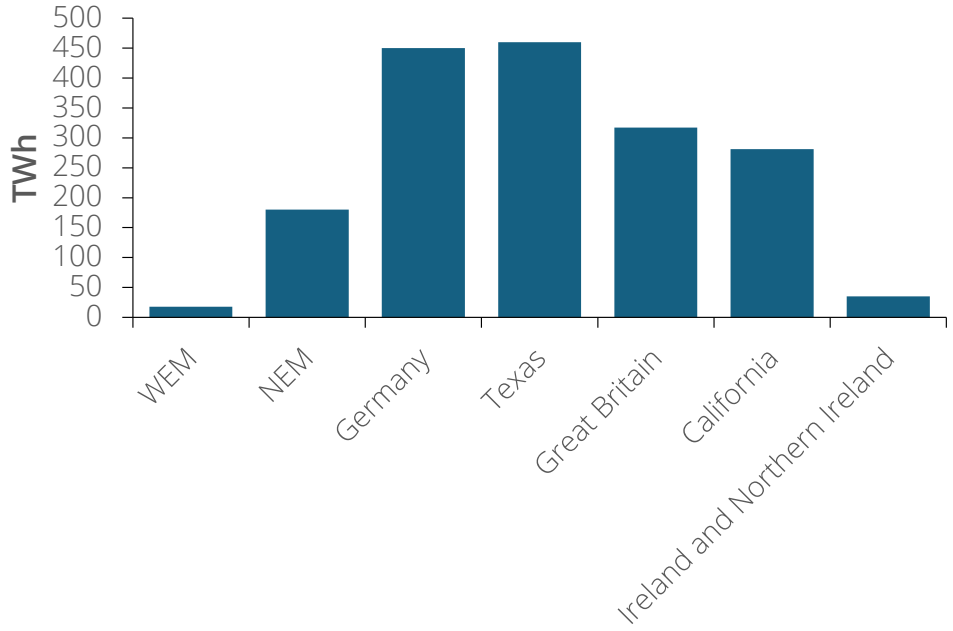
- Wind and solar* facility generation forecasts
- Weather inputs to demand forecasting
- DPV inputs to demand forecasting

* Solar has fewer events, but is grouped with wind as remedies are related

Inter-jurisdictional review

Key findings

Annual consumption TWh



The WEM was the smallest market in terms of annual energy consumption and an outlier in terms of DPV penetration

Intermittent generation

- Forecasting can be centralised (system or transmission operator) or de-centralised (participant).
- Where decentralised, there is typically a certification process for participants (e.g. California, NEM) and/or incentives in place for accurate forecasting (Germany)
- The WEM is partially decentralised, i.e. persistence forecasts blended with RTM offers with weak incentives for accurate forecasts
- Where DPV penetration is significant, forecasting cloud cover is a difficult and an ongoing issue
- Visibility of DPV and increasing DER is also an ongoing concern

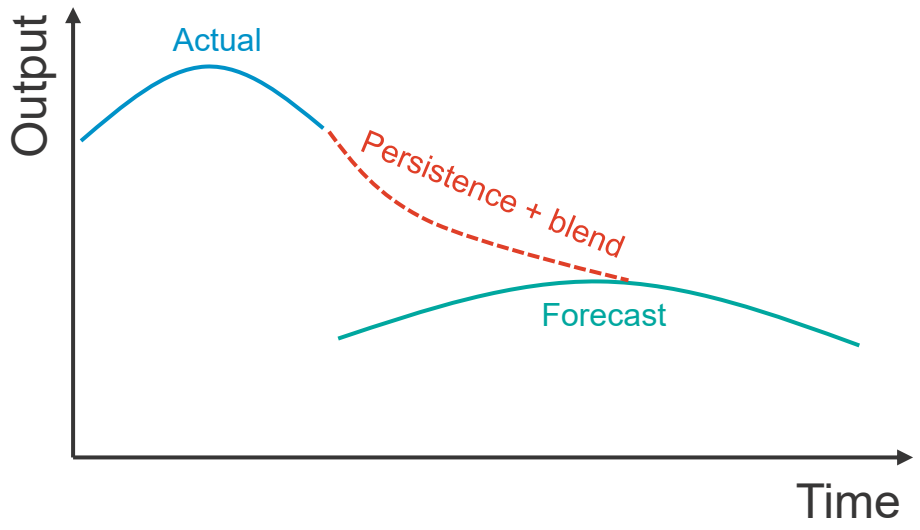
How other jurisdictions are improving forecasts

- Focus on improving *input* forecasts – weather forecasting
- Partnering with meteorological services
- Development of input modelling approaches e.g. deep learning to augment or replace numerical weather prediction models

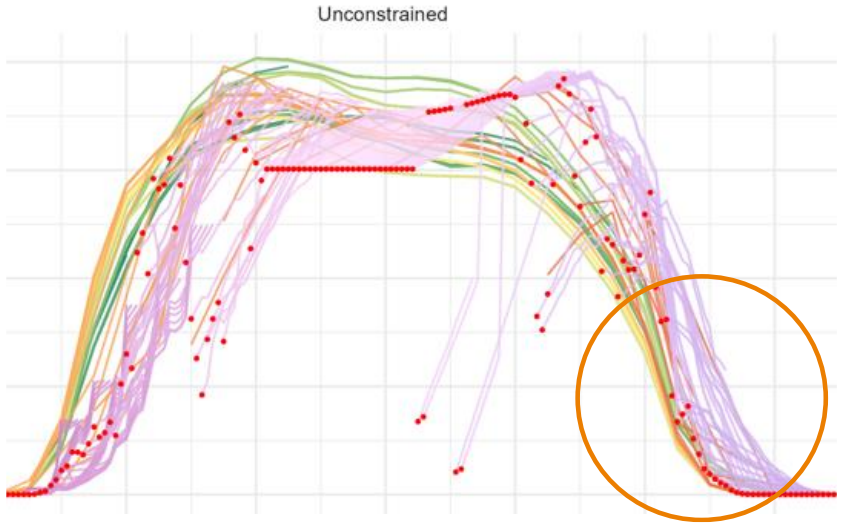
Proposal 1: Reconsider blending parameters

AEMO should review its approach to persistence forecasting

Persistence forecasting with blending is a method to bring erroneous short-term forecasts in line with actuals observed. This works by linearly blending the last observed value with future forecast values over a defined period of time (e.g. two hours).



- Persistence + blending may reduce forecast error in circumstances where short-term forecasts are inaccurate.
- Persistence + blending may also increase forecasting error when short-term forecasts are accurate. For example, when wind output is expected to drop suddenly – this drop will be overridden by persistence + blending. This issue is frequently observed in solar forecasts.



- Options for review include shortening the period over which it blends these forecasts, blending differently for different sites, or not blending at all and adopting an alternate approach.

Feedback

Proposal 1
AEMO should review its approach to persistence forecasting and how these forecasts are blended with foundation forecasts. AEMO should consider shortening the period over which it blends these forecasts, blending differently for different sites, or not blending at all and adopting an alternate approach. **(1)(a)** Do stakeholders have any concerns with AEMO altering its approach to blending forecasts?

Proposal 2: Investigate collaboration with weather providers

AEMO should consider further collaboration with weather providers

Improvements in demand and intermittent generation forecasting models are driven by either **improvements in the models** or **improvements to inputs into these models.**

Electricity demand and intermittent generation models rely heavily on **weather forecasts** and so by improving the **accuracy, frequency and understanding of uncertainty** of weather forecasts we can improve electricity forecasting.

Much of the effort in reviewed jurisdictions is targeted at improving weather forecasts in **collaboration with weather providers**.

- AEMO in the WEM works with numerous weather providers to assist in understanding weather forecasts for use in electricity forecasting.
- This proposal is aimed at taking this collaboration to another level and working with providers to improve different aspects of existing forecast products.
- New techniques (such as deep learning replacing or augmenting numerical weather prediction models) are being explored in other jurisdictions.

Feedback

Proposal 2
AEMO should enhance collaboration with a number of weather providers to improve weather forecasts used in demand forecasting and especially for intermittent generation resource availability forecasts. Specifically, the focus should be on improving the quality, frequency, and understanding of uncertainty of weather forecasts, and enabling delivery of these forecasts in a state that can inform market forecasts. **(2)(a)** Do stakeholders see a role for participants to provide or utilise additional site-specific data in forecasting?

Proposal 3: Enhance documentation and processes

AEMO should continue to develop documentation of forecasting processes and review forecasting practices

Model documentation is important for operability, transparency and reproducibility.

Model documentation should be written so parties unfamiliar with the model can understand how it works at a detailed level. This documentation should be kept up-to-date as models and processes change.

Forecasting practices (including day-to-day processes and changes to models) should be designed to minimise the possibility of error (e.g. deploying the wrong model).

- AEMO's institutional knowledge should improve with enhanced documentation.
- AEMO is further developing documentation regarding forecasting models and processes.
- AEMO has separate production and development environments.
  AEMO should always ensure these remain separate.

Feedback

Proposal 3
AEMO should continue to develop documentation of its forecasting process, including how it is implemented in its forecasting model, as well as a technical specification for the model. AEMO should review the use of its separate development and production environments for its forecasting system and the change management processes in place. **(3)** Do stakeholders have any concerns with AEMO enhancing documentation and reviewing internal forecasting practices? EPWA is considering amendments to section 2.36 of the ESM Rules to clarify what is meant by the term 'software'.

Proposal 4: Address the lack of incentive to produce accurate intermittent generation forecasts

Implement a centralised intermittent generation forecast approach performed by AEMO

Participants currently produce intermittent generation forecasts via RTM submissions, to which AEMO applies persistence + blending.

Current incentives for accurate intermittent generation forecasting are weak (cl 7.4.2 ESM Rules, “reasonable endeavours”).

Designing incentives for participants to accurately forecast is difficult – incentives should be proportional to ‘harm’ (inefficiency) of inaccurate forecasts, which is difficult to measure.

AEMO vs participants producing forecasts has different advantages and disadvantages – e.g. economies of scale, diversity of thought, potential for gaming.

- On balance, EPWA’s view is that it is preferable for AEMO to produce intermittent generation forecasts.
- AEMO would need additional data to produce intermittent generation forecasts, likely including:
  - Information and data relating to energy conversion models.
  - Detailed information about planned and unplanned outages.
  - For hybrid facilities, information about intended utilisation of dispatchable components.
- Introduction of the WEM Deviation Method may allow participant self-forecasting in the short-term (somewhat similar to arrangements in the NEM).

Proposal 4: Address the lack of incentive to produce accurate intermittent generation forecasts

Data requirements

- The NEM Operational Forecasting and Dispatch Handbook for wind and solar generating units offers an idea of the data required for energy conversion models.

Table 1: List of critical ECM SCADA signals for wind and solar farms

Technology type	Critical ECM signal	Description
Wind and Solar	Active Power (Wind: farm and cluster-level Solar: farm-level)	• The total active power measured at the agreed point of dispatch (Point of Connection (POC)). • Used by AWEFS/ASEFS to produce the dispatch UIGF during unconstrained farm operation. This is deemed an active power-based forecast.
	Control System Set-Point (farm-level)	• The Active Power Set-Point applied in the farm's control system to limit (down-regulate) its output. This signal should equal the semi-dispatch level when a semi-dispatch cap is set. • Used by AWEFS/ASEFS to detect if the farm is under constrained or unconstrained operation.
	Local Limit (farm-level)	• The lower of the farm's plant availability and all technical limits on the capacity of its connection assets to export energy. • Used by AWEFS/ASEFS to cap the dispatch UIGF in the dispatch timeframe.
Solar only	Number of Inverters Available (cluster-level)	• The number of inverters connected and available to deliver active power (if sufficient sunlight is available). • Used by ASEFS to produce the dispatch UIGF during constrained operation. This is deemed a weather-based forecast.

Feedback

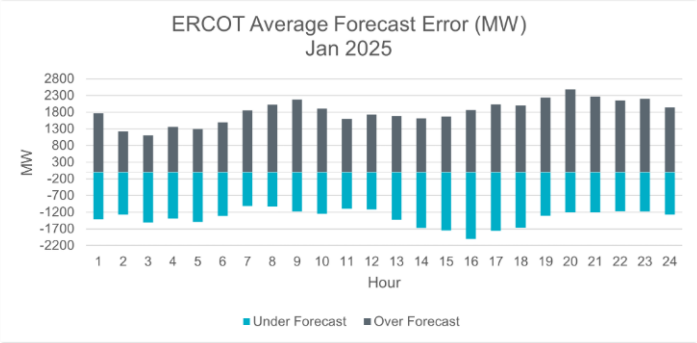
Proposal 4
Intermittent generation forecasts used in WEMDE should be produced by AEMO. Participants should be required, under the rules, to provide necessary information for AEMO to produce these forecasts. **(4)(a)** Do stakeholders support introducing a centralised forecasting approach with AEMO producing intermittent generation forecasts for use in WEMDE? **(4)(b)** Do stakeholders have concerns about providing the required information to enable AEMO to produce intermittent generation forecasts to be used in WEMDE? **(4)(c)** Do stakeholders have any views on the allocation of the implementation costs to move towards a centralised forecasting approach? **(4)(d)** Do stakeholders anticipate challenges in providing the type of data required to AEMO in a timely manner? **(4)(e)** Do stakeholders have any views on the proposed treatment of hybrid facilities?

Proposal 5: Publish operational forecasting metrics

AEMO should publish operational forecasting accuracy metrics at regular intervals

Forecast accuracy metrics can indicate how reliable different forecasting processes are. Publishing forecasting accuracy metrics can improve stakeholder confidence, highlight issues and provide evidence for a need for change.

ERCOT in Texas produces a suite of metrics (including backcast accuracy) which may serve as a good starting point.



- Forecasting accuracy assessment exercises indicate how reliable forecasts are on different bases (e.g. different numbers of hours ahead, different times of day etc).
- Backcasting exercises can indicate whether forecast inaccuracy relates to model construction/training or inaccurate inputs (primarily weather inputs).
- Understanding when and why forecasts are less reliable is important for ongoing improvement of forecasting approaches.

Feedback

Proposal 5
A rule obligation should be introduced for AEMO to publish metrics for the tracking of forecast and backcast errors for its operational forecasting. **(5)(a)** Do stakeholders support the introduction of an obligation for AEMO to publish a metrics of forecast and backcast errors?

Proposal 6: Formalise large load information provision

Operators of unscheduled large loads should be obligated to provide AEMO with consumption forecasts and updates

Unscheduled large loads currently provide self-forecasts to AEMO on a voluntary basis. AEMO uses these forecasts in producing demand forecasts.

This voluntary approach has worked to date but presents a risk to AEMO's forecasting procedure.

With a formalised arrangement, AEMO may be able to use self-forecasts to improve system operation e.g. in constraint equations.

- EPWA understands that the existing large loads are not weather sensitive, and so 'self-forecasting' is essentially a process of converting short-term operational plans into electricity consumption levels.
- Implementing this change will likely put the obligation on the Market Participant responsible for the settlement of the load (instead of creating new participant classes/types).
- EPWA and AEMO are currently discussing the threshold at which it would apply.
  The current thinking is to set the threshold at a maximum demand of 20MW in a year.

Feedback

Proposal 6
Operators of large loads should be obligated to provide AEMO with consumption forecasts and notify AEMO of unexpected changes to forecast schedules as they arise. **(6)(a)** Do stakeholders have any concerns with the proposal to formalise a requirement for large loads to provide consumption forecasts?

Next steps

- Consultation period closes 5:00pm (AWST) on 28 August 2025
- Submissions should be sent to energymarkets@deed.wa.gov.au

  Please note the new email address to reflect our department change
- We will not be able to accept late submissions
- Please provide your feedback as soon as practical
- Stakeholder feedback will inform the drafting of the Amending Rules
- It is expected that the Amending Rules will be included in the upcoming Tranche 9 Exposure Draft for public consultation