Department of Energy and Economic Diversification

GOVERNMENT OF WESTERN AUSTRALIA

Energy Policy WA

Scope of Work

Improving visibility for operational forecasting in the WEM, including DER

1. Introduction

Variations in demand and generation forecasts from actual levels can increase the costs associated with managing power system operations.

Significant factors associated with forecast error in operational time scales include:

- Visibility of large block load operations, including:
  - Visibility and behaviour of intermittent loads co-located with generation;
  - Variations from operational plans; and
  - Facilities not bidding in their Scheduled Withdrawals
- Variations in actual temperature from temperature forecasts leading to under- or over-estimation of the demand of temperature dependant loads, such as residential air-conditioning.
- The reliability of wind resource forecasts.
- Complexity and uncertainty in solar irradiance over rooftop solar installations, including:
  - Distribution: i.e. uncertainty of the total size of solar resource located behind each TNI or network constraint that limits the ability to forecast aggregate output in that area; and
  - Dynamic changes: i.e. cloud cover resulting in sudden changes in output from rooftop solar installations in different areas of the SWIS.
- Movements of “off market” aggregated Distributed Energy Resources (DER) and other price sensitive resources, for example direct network attached storage used for Network Support Services (NSS), not captured through the Reserve Capacity Mechanism (RCM) (including Supplementary Capacity Contracts) or Non-Cooptimised Essential System Services (NCESS) services.

The objective of this review is to recommend changes that can be implemented in the near-term to improve AEMO’s forecasting ability relative to its current state by better managing these uncertainties.

2. Background

2.1 Behaviour of block loads

Variations in large block loads, for example mining operations or large industrial load, can result in significant errors in AEMO’s Unscheduled Operational Demand Forecasts. Currently notifications by these loads regarding their planned operations are reliant on manual and ad-hoc processes with no clear requirements in the WEM rules.

As large loads consider on-site solar, wind or battery storage additions, risks increase that associated variability in net injection or withdrawal will increase. Consequently, AEMO may have need for greater visibility of behind the meter information or more frequent updates on equipment behaviour.

AEMO has identified that improvements in this area could reduce forecast uncertainty. Additionally, there is value in understanding if loads that are required to provide higher quality information about their withdrawal profiles, resulting from participation in Demand Side Programmes, are meeting these requirements.

2.2 Increasing contributions from wind and solar generation

Increasing reliance on weather dependant forms of generation will mean that weather forecasts (both temperature and wind resource availability) will be increasingly important in managing energy dispatch. AEMO should be supported in implementing best practice in this area.

In the NEM, AEMO uses the Australian Wind Energy Forecasting System (AWEFS) and Australian Solar Energy Forecasting System (ASEFS) to assist with semi-scheduled and non-scheduled forecasts of wind and solar.[1] AEMO has also introduced optional self-forecast capability in the NEM to reduce forecast error[2] alongside improvements to cost allocations based on a 'causer pays' approach.

Opportunities may exist to improve the data gathering on wind and solar resource and the sharing of high-quality data with market participants or publicly to improve market outcomes.

2.3 Forecasting DER behaviour

DER Roadmap

The DER Roadmap sets out a portfolio of actions to fully integrated DER into the energy system. The DER Roadmap Third Progress Report, released in 2024, with Action 38 addressing DER visibility.

"From January 2025, EPWA, in collaboration with AEMO, introduce changes to WEM Rules and service definitions to enable DER participation, including in the Reserve Capacity Mechanism and to implement visibility requirements."

The DER Roadmap Project Symphony VPP pilot completed in 2024 and provided insights on DER visibility that should be considered in this project.

AEMO Visibility Framework

In 2022, AEMO undertook consultation on a proposed Virtual Power Plant Visibility Framework which resulted in the publication of an '*AEMO WEM VPP Visibility Guideline*' in January 2023. AEMO's Visibility Framework proposed a staged approach reflecting the emerging nature and small scale of VPP activity now and its expected growth to materiality.

[1] australian-wind-energy-forecasting-solar-energy-forecasting-system.pdf (aemo.com.au)

[2] AEMO | Participant Forecasting

DER Roadmap Roles and Responsibilities Phase 2

The DER Roadmap project '*DER Roles and Responsibilities Phase 2*' project found that improvements in accuracy of forecasting 'baseline' or normal behaviours of DER are required as behind-the-meter generation and storage grow. Historically this information has relied strongly on weather data and the assumed fleet size, using a small sample of DER equipment.

Increasingly, Western Power will have improved meter data from its advanced metering program and aggregators will have asset data from ongoing monitoring and telemetry, including via Synergy's emergency solar management capability. Opportunity exists to use this data to improve the accuracy of forecasts of aggregated and non-aggregated rooftop solar and other DER across the whole of the SWIS, including better understanding of cloud cover changes, that can impact energy flows in specific areas and create high levels of volatility.

Western Power Network Support Services and Dynamic Operating Envelopes

Under the DER Roadmap and its DSO Strategy Western Power is progressing several initiatives around DER that could have implications on the need for visibility and forecasting.

Local Network Support Services – Following learning from Project Symphony, and the success of flexibility service offerings in other jurisdictions, Western Power is progressing work to source alternative, localised network support services (NSS) from DER at scale from 2025.

Under an NSS contract an aggregator will use DER to provide energy injection, shift battery discharge, or limit withdrawal to address temporary network limits (for example to prevent transformer or line overloads during high local demand ahead of planned network investment), or as an alternative to longer term 'poles and wires' investment. These services are expected to occur at a level that is below the normal visibly of AEMO, i.e. below the distribution/transmission interface. If deployed widely, localised NSS delivered by DER may have material impacts at a system level.

It is important that AEMO has visibility of such contracts and associated energy movements (expected or actual) within operational and planning timeframes.

While procurement of localised NSS within the NCESS framework is likely to improve visibility to AEMO potential visibility gaps may remain and there is a need to ensure that appropriate information transfer is occurring.

Dynamic Operating Envelopes (DOE) - Western Power is progressing its capability to offer DOEs, or Flexible Connection Arrangements for DER customers, like those being rolled out in South Australia[3] and other states.

DOEs will reflect local network constraints that could limit the energy injected into or withdrawn from the grid by DER. To ensure AEMO can manage PSSR effectively, it will need to have visibility of DOEs used by Western Power. This varies from the existing approach which assumes fixed injection or withdrawal limits.

Under Action 26 of the DER Roadmap[4], this capability is targeted to be available from Mid-2025, although it is likely to be longer before the impacts on DER become material at a system level.

[3] Fixed v Flexible - SA Power Networks

[4] Distributed Energy Resources Roadmap Third Progress Report (www.wa.gov.au)

2.4 Relevant WEM Reforms

Cost Allocation Review

Changes underway as part of the Cost Allocation Review[5], specifically those that relate to costs of managing variability, will likely provide greater incentive for DER aggregators to manage DER behaviour in ways that reduce market participant exposure to these costs.

DER integration in Reserve Capacity Mechanism

In 2024, EPWA is progressing rule changes to better enable aggregated DER to participate in the Reserve Capacity Mechanism, including by injecting energy. These changes will facilitate capability provided through recent SRC and NCESS processes being available through the general RCM going forward.

AEMO 2024 SWIS Engineering Roadmap

The AEMO Engineering Roadmap[6] highlights areas that require additional work, including around power system security, power system operability, and resource adequacy and capability as the volume of intermittent generation increases and synchronous generation decreases. This includes growth in rooftop PV and other DER.

The Engineering Roadmap highlights challenges and work that is needed in visibility, forecasting, power system modelling, and other areas relevant to this project.

3. Project Scope

This review will proceed in three stages:

- Stage One:
    - Undertake an inter-jurisdictional review, including recent NEM 'Unlocking CER benefits through flexible trading' changes, associated with of how other power systems are managing visibility and forecasting of energy movements for large loads, the impact of changes in temperature forecasts on temperature dependent loads demand, the DER aggregation movements (controlled and uncontrolled), and impact of short-term weather changes (including intermittent cloud cover, and wind resource availability) on renewable generation such as wind and solar. The review should examine:
        - How behaviours of large loads and interruptible loads are forecast, updated, and monitored.
            - Large loads with co-located generation can vary their operations from provided forecasts at short notice, including switching from generation to load.

[5] Cost Allocation Review (www.wa.gov.au)
[6] swis-engineering-roadmap.pdf (aemo.com.au)

- How solar and wind resource availability is forecast and how much forecasts vary from actual unconstrained output levels. This should capture at least.
    - the frequency of facility forecast submission updates;
    - If and how wind speed data is captured over various time horizons and geographic space. i.e. is data captured for variations across wind farms or within wind farms to provide more granular detail.
    - Whether local wind speed data captured by facilities is share with the operator or by the operator with the market.
    - How factors like overspeed are considered over various time horizons.
    - If and how the distribution of rooftop solar across the power system is considered, for example aggregated at the transmission connection or impact on constraints, in terms of impact of the passage of cloud cover or other relevant weather factors on different parts of the network.
- How temperature dependant loads forecasting is managed in response to variations in weather forecasts. This should account for jurisdictions where distributed solar is solely considered as a reduction in net customer load presented to market;
- How changes in behaviour of aggregated DER (generation or load) that are not actively participating in the wholesale electricity market are made visible and reflected into operational forecasting.
- What tools, processes, frameworks or capabilities are used for forecasting and planning of grid scale battery storage levels. This should consider operational and planning timeframes.

- Assess the order of materiality of the sources of error currently associated with the AEMO forecasts or expected as DER increases in capability;
    - This should quantify the source of the error, the size of the error, and whether it is easily addressed by rule changes.
    - It should highlight differences between supply side error, such as that associated with scheduled resources, and demand side forecasts associated with large loads and how the notional wholesale meter structure may mask the ability to understand changes within residential and other small user loads (including those co-located with DER).
- Understand how operational, probabilistic forecasts are turned into real-time decision-making tools, including managing the spread of forecasts available in real time. How do ISOs translate risk and variability in demand and wind profiles into decision making tools. e.g. different temperature forecasts can drive large variations in demand outcomes.

    - Identify current and expected visibility needs for AEMO and Western Power to address the above forecasting uncertainties.

- Stage Two: Identify gaps in existing sources of information or tools used by AEMO as well as the WEM Rules related to the visibility and forecasting needs identified in Stage One. For example, the DER Register is used by AEMO to capture static information on new DER installations and this information may also be of use in improving operational forecasting.

- Stage Three: Based on the outcomes of Stages One and Two, recommend further actions (including the use of methodologies, models, other tools and processes) and develop any WEM Rule changes required, as well as any other regulatory changes that might be required or desirable, to enable the provision of such information as is required to improve the capability of AEMO and Western Power to undertake their operational forecasting functions. Recommendations should consider that the passage of the DER Bill and the subsequent breadth of heads of power under the Electricity System and Market Rules (ESMR)

The review is expected to take around four months from consultant engagement to final WEM Amending Rules. Further reasonable time would be allowed for AEMO, Western Power, and other parties to implement any necessary systems and process changes.

3.1 Scope of Work

EPWA will engage a consultant to assist with this work, to assess options and provide recommendations for any rule changes required to support improved operational forecasting. The scope of work will be to:

- Undertake an inter-jurisdictional review to establish best practice approaches, methodologies, models, and information sources used by market operators for forecasting on operational timescales (including large loads and temperature dependent loads), renewable generation and DER behaviour. The review should include the NEM, California, Texas, Germany and other jurisdictions with high levels of wind and solar (including rooftop) or retail driven DER activity, for example by virtual power plants. This should allow a baseline of how AEMO WA compares over various time horizons.

- Assess the order of materiality of the sources of error currently associated with the AEMO forecasts to identify priority areas that can deliver fast improvements with high levels of cost effectiveness.

- Evaluate existing and draft WEM Rules and WEM Procedures and other material relevant to the project and develop policy positions around visibility and forecasting requirements.

- Assess WEM Rule or process changes needed to facilitate the visibility and forecasting requirements of AEMO and Western Power and make recommendations for other actions that can improve visibility and reduce forecast error.

- Recommendations and changes should include consideration of:

    1) Load forecasting.

        - Improving the visibility of block load customers' operational plans.
        - Improving forecasting of temperature dependant loads, or negative load from rooftop PV output.

    2) Renewable Resource Forecasting.

        - Improvements to AEMO weather and cloud forecasting to reduce uncertainty associated with solar and wind farm output.
        - Accessing measurement techniques and equipment (such as Western Power's Advanced Metering capability, or aggregator telemetry) to provide actual performance data in different areas of the SWIS that can inform and improve operational forecasting.

    3) DER activity.

        - Static information requirements regarding DER and DER aggregations and how often this information should be updated.
        - Dynamic information regarding DER aggregation injection or withdrawal (forecasts and actuals), including thresholds for reporting and how these are calculated.
        - Barriers to meeting visibility/forecasting requirements under different scenarios, noting that third parties will likely provide services to market participants, for example to Synergy.
        - Additional costs that are likely to apply to DER aggregators to meet any visibility requirements and how this may raise a barrier to the development of aggregated DER capability, especially in early stages of service development.
        - Any requirement for AEMO or Western Power to publish visibility information alongside other market data.
        - Limits to the application of visibility and forecasting requirements on parties that are not Market Participants, for example aggregators, or how these requirements may relate to the responsibility of the Financially Responsible Market Participant. Noting that the DER Bill provides heads of powers that will allow ESMR to make rules that apply to these parties.

3.2 Consultation

- AEMO and Western Power will be engaged to understand their current practices, visibility needs and the use cases related to DER energy movements.

- Large load customers should be engaged to understand existing processes and the scale of costs associated with improvements.
- Existing or potential DER aggregators in the SWIS should be engaged to understand costs and barriers associated with the provision of visibility information.

3.3 Other Considerations

Constraints

- DER aggregations and third-party services are still in early stages of development. Visibility requirements should be implemented without onerous or unreasonable burdens or costs. A staged approach is likely appropriate.
- Visibility requirements should be implemented such that they do not require WEM registration for DER aggregators not providing WEM services. However, thresholds may still be needed for sizes of aggregations that do require some form of formal participation or market registration.
- Limits may apply to capturing activity of DER operated by parties that are not Market Participants. Consideration should be given to the likely materiality of these type of aggregators or service providers in the short term.

Implementation Risks

- Large load customers may resist formalising existing notification arrangements.
- Forecasting weather impacts is inherently uncertain over operational timeframes.
- AEMO or other parties may have resourcing restrictions around implementing any required changes, with implications for the timing of the commencement of requirements.
- DER aggregators may be limited in their capability to provide required visibility prior to the development of detailed data specifications and communication processes by AEMO.
- Technical limitations of existing DER installations may limit the visibility information that is available from legacy equipment.

Out of scope

- This project does not include consideration of enabling aggregated DER participation in WEM services, for example the real-time market, STEM, or FCESS.
- The DER Register (WEM Rules Section 3.24) places a requirement on Western Power to provide static data on DER installations. Rules developed under this project should not replace or supersede DER Register requirements. However, the project may result in recommendations for improvements to the DER Register that can be progressed by other work packages.
- This project will not define the communication protocols or data structures by which minimum visibility information will be communicated to AEMO or Western Power, however it could outline minimum data items to be captured in these.

4. Project Schedule

Tasks/Milestones	Completed by
Project establishment	
Internal approval of Project Scope of Work.	August 2024
Deliverables	
EPWA engage consultant to assist with the Project delivery.	Aug – Sept 2024
Assessment of order of materiality of sources of error	Sep 2024
Deliverable A: • Inter-jurisdictional review, identification of visibility needs.	Oct 2024
Deliverable B: • Summary of gaps and recommendations to improve visibility.	Nov 2024
Deliverable C: • Consultation paper and Exposure Draft of WEM Amending Rules.	Dec 2024
Deliverable D: • Final WEM Amending Rules, and summary of feedback on consultation paper and Exposure Draft of WEM Amending Rules.	Jan – Feb 2025
Implementation	
Implementation of Visibility & Forecasting improvements by AEMO.	End 2025