2021 FORECAST IMPROVEMENT PLAN

FINAL DETERMINATION

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EXECUTIVE SUMMARY

The publication of this final determination concludes the consultation process conducted by AEMO to improve its forecasting under the National Electricity Rules (NER) Clause 3.13.3A (h)(2). AEMO published its annual Forecast Accuracy Report (FAR) in December 2021 and asked for stakeholder feedback on the Forecast Improvement Plan included in the FAR.

This document outlines AEMO's responses to key issues raised in written submissions[1], specifically:

- Underestimation of installed rooftop PV
- Battery storage forecasts
- Forecasting "prosumer" uptake and usage of DER
- Greater visibility of DER and Battery data

The responses are compiled in this final determination, which has been published along with the final Forecast Improvement Plan and each received submission on AEMO's website[2].

[1] Available at: https://aemo.com.au/consultations/current-and-closed-consultations/2021-forecast-improvement-plan-consultation
[2] See https://aemo.com.au/consultations/current-and-closed-consultations/2021-forecast-improvement-plan-consultation

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1. STAKEHOLDER CONSULTATION PROCESS

As required by the National Electricity Rules (NER) Clause 3.13.3A (h)(2), AEMO must publish any improvements made by AEMO or other relevant parties to the forecasting process that will apply to the next Electricity Statement Of Opportunities (ESOO) for the National Electricity Market (NEM), in accordance with the Reliability Forecast Guidelines[3].

AEMO consulted on its Forecast Improvement Plan that outlines proposed forecasting improvements that may apply to the 2022 ESOO.

AEMO's timeline for this consultation is outlined below.

Deliverable	Indicative date
Forecasting Reference Group discussion of draft Forecast Accuracy Report and Forecast Improvement Plan	27 October 2021
Forecast Accuracy Report and Forecast Improvement Plan Published	22 November 2021
Submissions due on Forecast Improvement Plan	22 December 2021
Final Forecast Improvement Plan and final determination published	4 February 2022

The publication of this final determination and final Forecast Improvement Plan concludes the consultation process.

A glossary of terms used in this Draft Report is at Appendix A.

2. BACKGROUND

2.1. Context for this consultation

As required by NER clause 3.13.3A(h) AEMO must, no less than annually, prepare and publish on its website information related to the accuracy of its demand and supply forecasts, and any other inputs determined by AEMO to be material to its reliability forecasts. This requirement is met by the publication of the Forecast Accuracy Report (FAR)[4].

The FAR includes information related to proposed improvements to the forecasting processes that may apply to the next ESOO, with a particular focus on those arising from forecast deviations.

In accordance with AEMO's Reliability Forecast Guidelines[5], AEMO consult on the Forecast Improvement Plan part of the FAR using the single stage consultation process as outlined in Appendix B of the AER's Forecast Best Practice Guidelines[6]. An FRG discussion on the topic was also held[7].

2.2. Consultation

AEMO issued a Notice of Consultation on 22 November 2021 along with its Forecast Improvement Plan detailed in Section 8 of the 2021 FAR.

The priority improvements proposed for 2022 and the subject of this consultation are listed below:

[3] Available at: https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-approach

[4] Available at: https://aemo.com.au/consultations/current-and-closed-consultations/2021-forecast-improvement-plan-consultation

[5] See Section 4.2 in https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2021/reliability-forecast-guidelines.pdf

[6] Available at: https://www.aer.gov.au/system/files/AER%20-%20Forecasting%20best%20practice%20guidelines%20-%2025%20August%202020.pdf

[7] See the 27 October 2021 FRG minutes, available in 2021 meeting pack 10 at: https://aemo.com.au/en/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/forecasting-reference-group-frg

1. Review initial year of forecast maximum and minimum demand distribution
2. Review auxiliary load forecast
3. Improved visibility of sectoral consumption
4. Improve renewable generation and demand traces, including the quantity used, and their shape
5. Monitor for change in trends for key inputs
6. Monitor emerging technologies uptake and usage

Additionally, the Forecasting Research Plan includes research initiatives on:

- Sectoral modelling
- Future load shape from technology uptake and usage
- Consumption trends of Households with rooftop PV

AEMO received one written submission to the consultation, from Energy Queensland (EQL), a copy of which has been published on AEMO's website[8].

3. SUMMARY OF MATERIAL ISSUES

The key material issues arising from the proposal and raised by Consulted Persons are summarised in the following table:

No.	Issue	Raised by
1.	Underestimation of installed rooftop PV	EQL
2.	Battery storage forecasts	EQL
3.	Forecasting "prosumer" uptake and usage of DER	EQL
4.	Greater visibility of DER and Battery data	EQL

As noted in the FAR, this consultation focuses on the continuous improvement initiatives outlined in the Forecast Improvement Plan only, and not the FAR methodology (consulted on in 2020)[9], nor does it cover more material methodological changes that may be suggested as part of the four-yearly review of the Forecasting Approach[10].

4. DISCUSSION OF MATERIAL ISSUES

4.1. Underestimation of installed rooftop PV

4.1.1. Issue summary and submissions

In its submission, EQL noted that installed rooftop PV was under-forecast in all NEM regions in 2020, and associated flow-on impacts for minimum demand planning. EQL mentioned several trends that indicate installed rooftop PV capacity will continue to rise, including:

> New customers installing increasingly larger systems on average, and existing customers with PV who are replacing ageing systems with higher capacity and more efficient systems.

[8] See: https://aemo.com.au/consultations/current-and-closed-consultations/2021-forecast-improvement-plan-consultation
[9] See: https://aemo.com.au/consultations/current-and-closed-consultations/forecast-accuracy-report-methodology
[10] See: https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-approach

4.1.2. AEMO's assessment

Section 8.1 of the Forecasting accuracy report notes several forecast variances that are being addressed with existing forecast improvement initiatives, including:

> The 2020 distributed PV forecast uptake was lower than what was observed, while forecast generation per MW was above the observed. The under-forecast of capacity significantly affected the minimum demand forecast, while the over-forecast of generation per MW reversed that impact on consumption. With the 2021 ESOO forecast, these issues have both been addressed, although AEMO will monitor this to ensure no further actions are needed ahead of producing the 2022 ESOO forecast.

AEMO agrees that correctly forecasting distributed PV is important and have therefore included "Monitor for change in trends for key inputs", including distributed PV uptake and generation, as initiative #5 in the 2021 Forecast Improvement Plan. AEMO's DER forecasts, informed through independent modelling by Green Energy Markets (GEM)[11] and CSIRO[12], consider the increasing trend increasing trend in system size for both new and replacement PV systems.

4.1.3. AEMO's conclusion

AEMO seeks to work with EQL, other DNSP's and stakeholders in general to understand observations regarding distributed PV installation and capacity. Opportunities for engagement on this topic commences with the 30 March Forecasting Reference Group[15] meeting, which seeks stakeholder input on considerations for 2023 DER forecast development.

4.2. Battery storage forecasts

4.2.1. Issue summary and submissions

EQL described the importance of home battery forecasts, submitting:

> October 2021 was a record month for battery energy storage systems (BESS) connections in Queensland, with internal forecasts and customer engagement indicating volumes of small-scale solar PV and BESS installations will continue at a similar rate to that of 2020.
>
> Furthermore, as feed-in tariffs reduce, more customers are using BESS to offset consumption, typically in the evening. Engagement and research conducted with our customers indicates this will become more prevalent as the price of batteries reduces, making customer investment in storage more attractive and economical.

4.2.2. AEMO's assessment

AEMO have included the monitoring of emerging technologies uptake and usage as initiative #6 in the 2021 Forecasting Improvement Plan. As detailed in section 8.2.6 of the 2021 Forecast Accuracy Report:

> AEMO is working with distribution network service providers (DNSPs) to improve knowledge of existing battery storage installations in the DER Register and investigating methodologies to identify the operating profiles of battery storage installations."

[11] See section 3.5 of GEM's report, available at: https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/inputs-assumptions-methodologies/2021/green-energy-markets-der-forecast-report.pdf

[12] See section A.1.1 of CSIRO's DER report, available at: https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/inputs-assumptions-methodologies/2021/csiro-der-forecast-report.pdf

[15] https://aemo.com.au/en/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/forecasting-reference-group-frg

4.2.3. AEMO's conclusion

AEMO agrees that BESS uptake is growing and feed-in tariffs contribute to that growth. To best forecast future uptake, AEMO will seek stakeholder input during the 30 March FRG on what factors are to be considered in BESS uptake, their relative importance, and how they might be incorporated in the forecast.

4.3. Forecasting "prosumer" uptake and usage of Distributed Energy Resources (DER)

4.3.1. Issue summary and submissions

EQL stated their support for AEMO's initiative to monitor emerging technologies uptake and usage, and noted:

> We agree there is a strong need to forecast 'prosumer' uptake and usage of DER more accurately, in particular behind-the-meter battery storage and EVs (Electric Vehicles).

4.3.2. AEMO's assessment

AEMO currently forecasts DER uptake of the residential consumer base as a whole, while acknowledging that it represents a range of customers with different preferences, usage patterns and willingness to actively respond to market signals. AEMO forecasts do have elements that explore typical prosumer type behaviour, including its Demand Side Participation forecast, and the ratio of battery storage systems and EV chargers which optimise usage according to system conditions through virtual power plant (VPP) arrangements. AEMO acknowledge that this is a fast moving area and is keen to work closely with all stakeholders to ensure this segment is appropriately accounted for in AEMO's forecasts. For example, AEMO is keen to learn from EQL's EV SmartCharge trial, to ensure the EV charging behaviour in AEMO's modelling is consistent with what is observed in Queensland. AEMO's 2022 Standing Information Request[16] accordingly includes request for data related to EV uptake and charging where available.

4.3.3. AEMO's conclusion

AEMO acknowledge the range of willingness to adopt DER across residential consumers is inherent in assumptions regarding the market penetration of each technology over time, but feels the characteristics of different behaviour is appropriately captured in the current modelling, with the data available. It is known that actual usage patterns for these technologies vary considerably and AEMO seeks stakeholder feedback on such assumptions during forecast development, to ensure its forecasts reflect the best possible information.

4.4. Greater visibility of DER and Battery data

4.4.1. Issue summary and submissions

EQL requested that AEMO collect and publish more detailed DER data, including inverter and system peak capacity, orientation. EQL also suggested similar reporting for batteries, including installation rates, capacity and discharge given their impacts on network demand.

4.4.2. AEMO's assessment

Since its establishment (March 2020), the DER register[17] collects detailed system information. In designing the DER register, AEMO considered its forecasting needs, balanced with the cost to AEMO and others of

[16] See https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-reliability/standing-information-requests

[17] See https://aemo.com.au/en/energy-systems/electricity/der-register

sourcing and managing the data. Panel orientation is an example of data that did not need to be recorded directly, as the weighted impact of various panel orientations is inherent in the aggregate of metering data associated with rooftop PV installations in an area. Data that should be added is consulted on with stakeholders. For example, EV charging is on the Energy Security Board's agenda for 2022-23[18], and can potentially be added to DER register data collection.

For batteries, the DER register only captures uptake, capacity and energy, but does not collect dynamic information, so discharge profiles are unavailable.

AEMO considers two kinds of batteries:

- Those with locally optimised battery charge/discharge profiles – the profile estimations incorporate PV generation estimates[19]
- Other batteries (such as VPP) – AEMO's forecast models can dispatch such batteries to target system price spikes and reliability events.

The ratio of VPP controlled to locally optimised batteries is a scenario assumption and outlined in AEMO's Inputs, Assumptions and Scenarios Report (IASR)[20].

4.4.3. AEMO's conclusion

AEMO restricts its DER data collection to that necessary for AEMO and Networks to plan and manage the power system, so as not to impose a burden on organisations proving data. As there is a diversity of needs for additional data, and capabilities in data provision, organisations seeking additional information should develop plans to obtain it, and/or collaborate with their peak body to achieve economies of scale.

5. DRAFT DETERMINATION

Having considered the matters raised in the submission, AEMO's final determination is that no amendment to the 2021 Forecasting Improvement Plan[21] is required, which is now published as final.

[18] See 1630275857-esb-data-strategy-july-2021.pdf (datocms-assets.com)

[19] See p39 of CSIRO's DER report, available at: https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/inputs-assumptions-methodologies/2021/csiro-der-forecast-report.pdf

[20] Available at: https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/current-inputs-assumptions-and-scenarios

[21] Available at: https://aemo.com.au/consultations/current-and-closed-consultations/2021-forecast-improvement-plan-consultation

APPENDIX A. GLOSSARY

Term or acronym	Meaning
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
BESS	Battery Energy Storage Systems
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
DSP	Demand Side Participation
ESOO	Electricity Statement of Opportunities
EQL	Energy Queensland
EV	Electric Vehicles
FAR	Forecast Accuracy Report
FBPG	Forecast Best Practice Guidelines
FIP	Forecast Improvement Plan
FRG	Forecasting Reference Group
IASR	Inputs, Assumptions and Scenarios Report
ISP	Integrated System Plan
NER	National Electricity Rules
NSP	Network Service Provider
PASA	Projected Assessment of System Adequacy
POE	Probability of Exceedance
PV	Photovoltaics
RERT	Reliability and Emergency Reserve Trader
USE	Unserved Energy