Forecast Improvement Plan update

26 April 2023 FRG Meeting

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Purpose and agenda

The purpose of this presentation is to *Inform* the FRG of updates on forecasting improvement plan initiatives, following the end of consultation on the 2022 Forecast Improvement Plan (FIP).

Today's agenda includes:

- 2022 FIP summary
- Update on initiatives
- Discussion

Timing	Relevant topic	Responsible
Dec 22 - Apr 23	FIP consultation	AEMO, Stakeholders
Today	**Update on improvement initiatives**	**AEMO**
Aug 23	2023 ESOO published	AEMO

Summary of 2022 Forecast Improvement Plan

- Draft FIP was presented at the Oct 2022 FRG and identified the below focus areas:

IMPROVE	REVIEW	MONITOR	RESEARCH
Improve demand trace inputs, shape and quantity	Review forecast maximum and minimum distribution of the initial year of the forecast horizon	Monitor data availability of emerging technologies. Adopt if required	Collaborate with industry participants to share knowledge
Improve visibility of sectoral consumption	Review LIL and ONSG component forecasts	Monitor demand side participation. Escalate as required	Estimate behavioural change from customers with PV and batteries

- Public consultation on the Draft FIP ran between Dec 2022 and Feb 2023. Two submissions were received, which AEMO will respond to in the final FIP report (due this month), but these will not change the above focus areas.

Progress against the Plan (1/2)

Initiative	Status	Commentary
Improve demand trace inputs, shape and quantity		More detail in FRG Presentation 3.
Improve visibility of sectoral consumption		ANZSIC research project (part of CSIRO's NEAR Program, refer appendix) has mapped 500k NMIs to industry sectors, providing more granular insights on C&I consumption than previously available.
Review max/min demand distribution of initial forecast year		Completed for WEM (refer appendix). Will be repeated for the NEM, taking into account observations from 2022 Forecast Accuracy Report and review of 2022-23 summer outcomes (as presented at the last FRG).
Review LIL and ONSG component forecasts		More scrutiny is being applied to proposed LIL load expansions, whilst outages accounted for other forecast LIL variances. An end-to-end review of ONSG is underway. Additional work on LIL and ONSG will be done as part of the work on demand traces (presentation 3).

Work completed and will be included in 2023 ESOO

Partially progressed – will be included in 2023 ESOO

Yet to commence – unlikely to be included in 2023 ESOO

Progress against the Plan (2/2)

Initiative	Status	Commentary
Monitor data availability of EVs and emerging technologies		AEMO's expanded data sources now includes VFACTS quarterly EV uptakes (now including Tesla). AEMO's DER Register continues to be reviewed to support future insights on battery growth. AEMO is also engaged in the Enhanced System Planning – Victoria project, which is assessing the impacts of gas and transport electrification
Monitor demand side participation following introduction of Wholesale Demand Response (WDR)		WDR data is being analysed across each jurisdiction to obtain insights about size of response at various price points (refer appendix)
Collaborate with industry to share knowledge on battery and EV charge/discharge profiles		AEMO revised charge profiles, based on input and trial data from stakeholders (refer appendix). The draft 2023 IASR sought feedback on battery operations, with some submissions outlining considerations such as FCAS revenue.
Estimate behavioural change impacts on consumption profiles (from consumer energy resources)		This work is expected to kick-off in the coming months to assess changes to consumption profiles for households with rooftop PV and battery storage. Unlikely to be completed in time for 2023 ESOO.

Work completed and will be included in 2023 ESOO

Partially progressed – will be included in 2023 ESOO

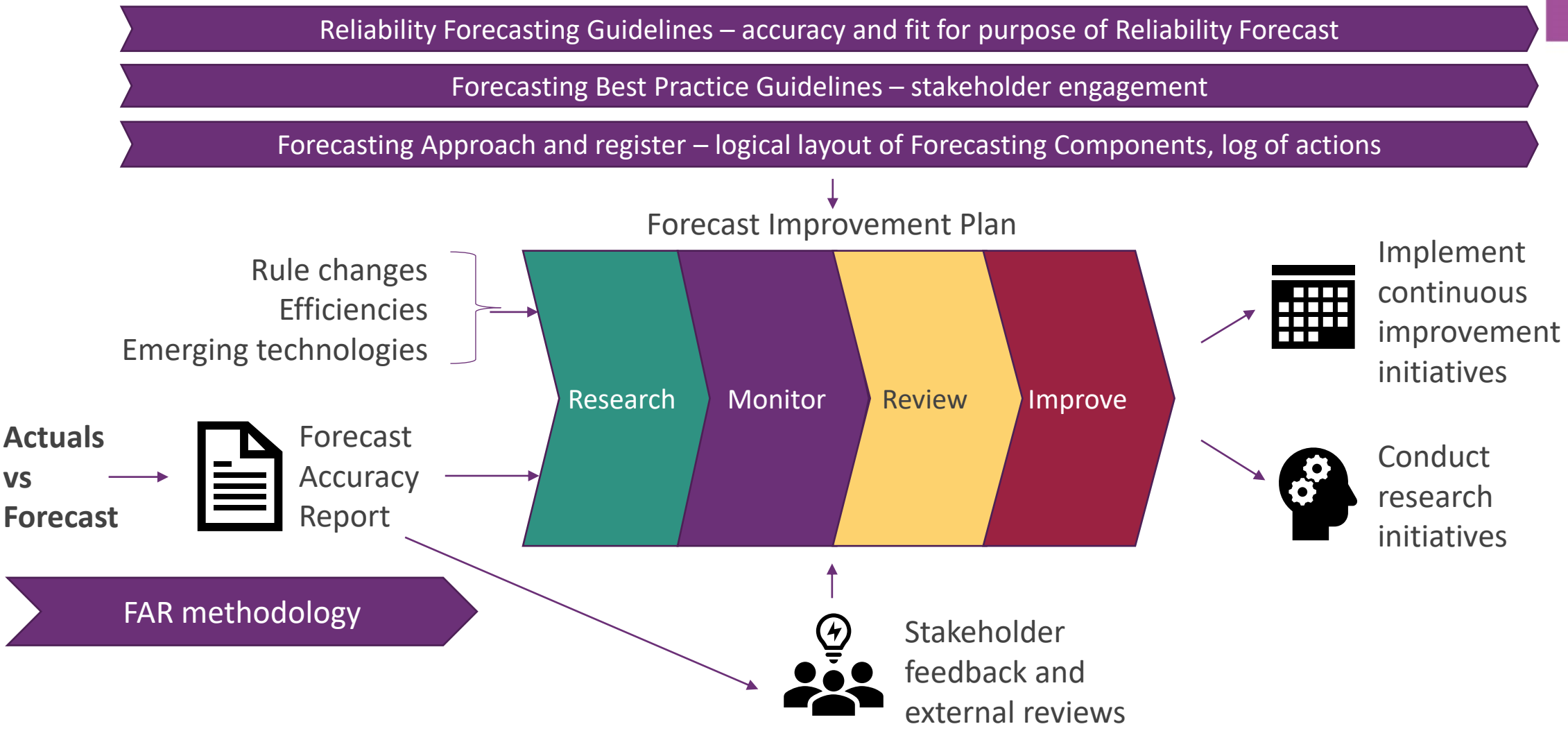
Yet to commence – unlikely to be included in 2023 ESOO

Discussion

Appendix

Further details on Forecast Improvement Plan initiatives

The Forecast Improvement Plan guides AEMO's ongoing technical improvements



Forecast Improvement Plan overview – review and improve

	Forecast Accuracy issue	Forecasting Improvement Plan	Details
IMPROVE	Improve demand traces – as presented at previous FRGs	Improve demand trace inputs, shape and quantity	Increase the number of weather reference years modelled in the ESOO to better account for the impacts of the growing share of weather-dependent generation.
IMPROVE	Limited ability to support sectoral level insights and inform future scenarios at sectoral level (slide 5)	Improve visibility of sectoral consumption	Continue to expand on individual consumption drivers within LIL and broader sectoral consumption. Informed by research project on ANZSIC code mapping.
REVIEW	Observed extremes in several cases fall outside the forecast distribution (slides 7, 8 and 11)	Review forecast maximum and minimum distribution of the initial year of the forecast horizon	The distribution of the initial year of the forecast horizon requires review. Consider improvements to the GEV model or alternatives to it if required.
REVIEW	Significant ONSG and LIL deviations observed for regional consumption (slide 6), and for LIL at time of max demand in Tasmania (slide 10)	Review LIL and ONSG component forecasts	Review ONSG and LIL consumption forecasts for opportunities to improve alignment with actuals. LIL affects max demand in Tasmania and the current modelling of this should be reviewed.

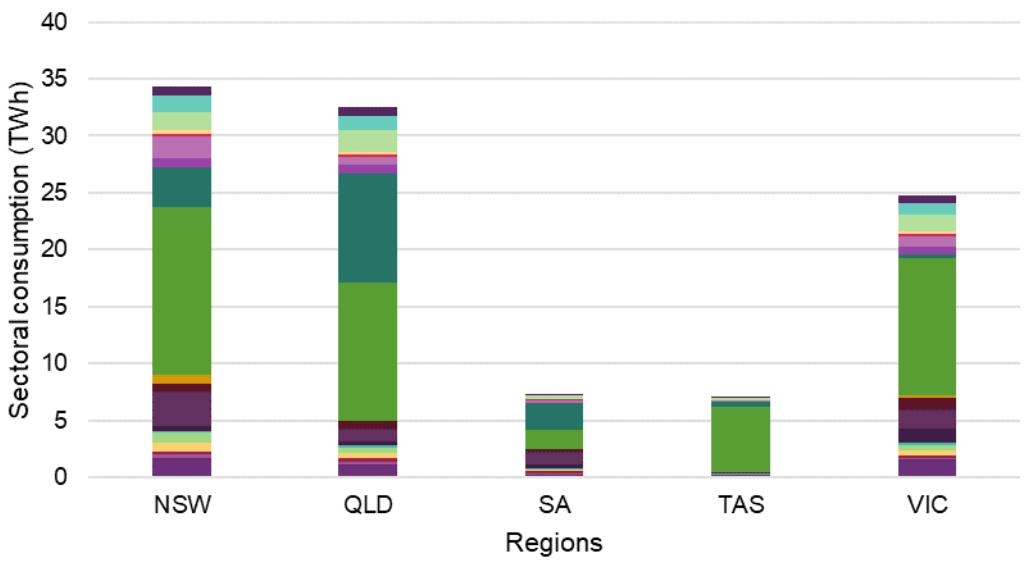
Forecast Improvement Plan overview – monitor and research

	Forecast Accuracy issue	Forecasting Improvement Plan	Details
MONITOR	Opportunity to track uptake of electric vehicles (EVs), batteries and other emerging technologies (slide 4)	Monitor data availability of emerging technologies. Adopt if required	Since last year, good data sources for EV sales have been identified, allowing tracking of EV uptake. AEMO keeps monitoring data sources for other technologies
MONITOR	Potential change to the level of demand side participation following introduction of wholesale demand response (WDR) (slide 21)	Monitor demand side participation. Escalate as required	Monitor observed DSP against actuals to see if historical responses remain an accurate estimation of current level of DSP, following introduction of WDR.
RESEARCH	Limited data available for usage (charge and discharge data) for battery storage systems (including VPP) and electric vehicles (slide 4)	Collaborate with industry participants to share knowledge	Continue knowledge sharing meetings with parties doing research in EV and battery storage
RESEARCH	Risk of maximum and minimum demand forecast errors if not accounting for behavioural change (slides 7, 8 and 11)	Estimate behavioural change from customers with PV and batteries	Consider how to measure and account for the impacts (on overall consumption and max/min demand) of behavioural change for customers with rooftop PV and/or batteries

Improve visibility of sectoral consumption

- Australian Govt uses Table F from the Australian Energy Statistics publication for energy and carbon emissions policy evaluation and development
- AEMO's consultants use Table F for their modelling (energy efficiency, economics forecasts and multisector modelling)
- Energy Forecasting uses Table F for business consumption modelling
- ANZSIC project provided a benchmark to assess Table F

Breakdown of business electricity consumption by ANZSIC* division (FY21)

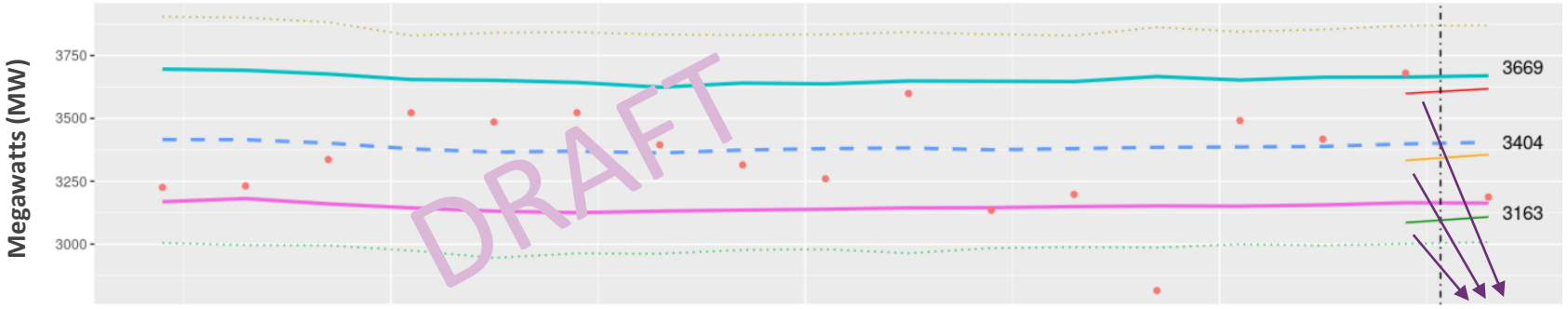


*Australian New Zealand Standard Industry Classification

- Table F aggregates Commercial & Services divisions and uses it as a residual sector; project provided first view of sectoral consumption
- Division C Manufacturing achieved a 95% match in terms of electricity consumption

Initial year - WEM ESOO 2023 Model Retraining example

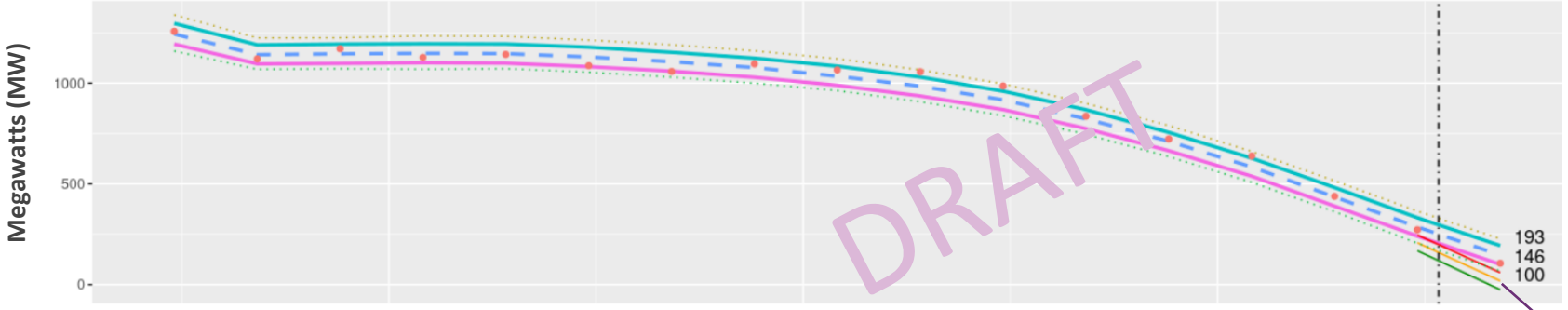
Summer Maximum Demand Forecast – OPSO no LIL



With the full 2022 data in the training data set, the hot summer ending in 2022 lifted Max Demand forecast.

Previous WEM GEV forecast

Shoulder Minimum Demand Forecast – OPSO no LIL



The combination of adding more recent demand data and model fine-tuning has addressed the recent under-forecasting bias.

Previous WEM GEV forecast

10% POE
50% POE
90% POE

Reviewing starting point of the winter maximum demand forecast

Initial year – additional analysis pointing towards additional NEM model changes

2022 Forecasting Improvement Plan:

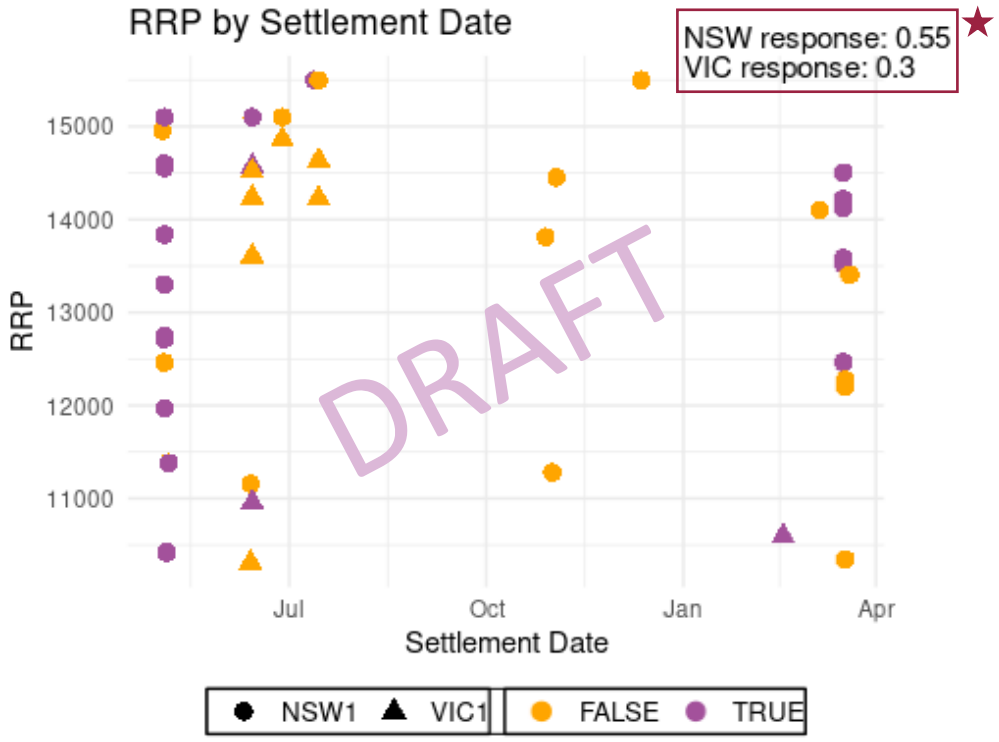
The distribution of the initial year of the forecast horizon requires review. Consider improvements to the GEV model or alternatives to it if required.

- **Review starting point of distributions for winter maximum and annual minimum forecasts.** Previous years' focus has been on improving the inputs, with the distributed PV forecast in particular being an issue. With that now improved, there is a need to improve the broader model performance. AEMO proposes to review the models used to set the starting points of the distribution, including whether additional weather variables like dew point (humidity) can improve model performance. Observed differences could also reflect an underlying change in customer behaviour, for example increased usage of heating/cooling load from customers that have invested in rooftop PV, that the modelling is not adequately picking up in maximum and minimum demand forecasting. This should also be investigated.

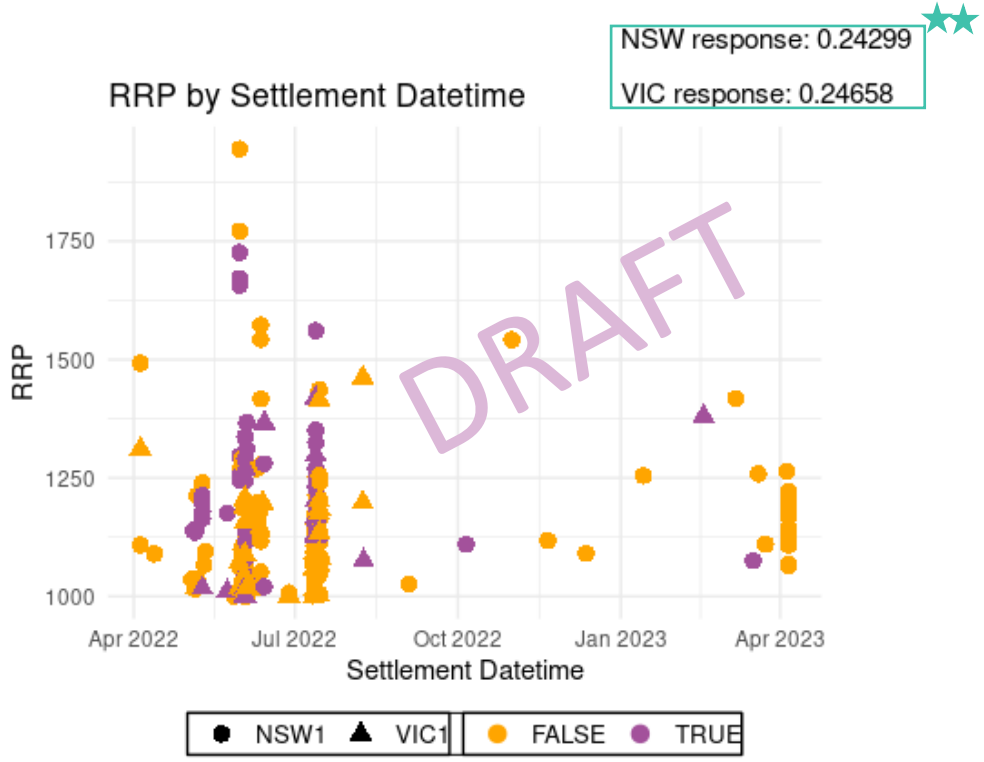
- Additional investigations undertaken along with the Synthetic trace initiative has shown improvements from adding additional variables related to reflecting humidity and impacts of heat waves.
- AEMO will continue the investigations, including whether the improvements (including reduced bias) can remove the need for the GEV model to set the starting point.
- AEMO will use this approach in the 2023 ESOO if same or better outcomes can be achieved.

Wholesale demand response

WDR between $10,000-$15,000/MWh



WDR between $1,000-$2,000/MWh

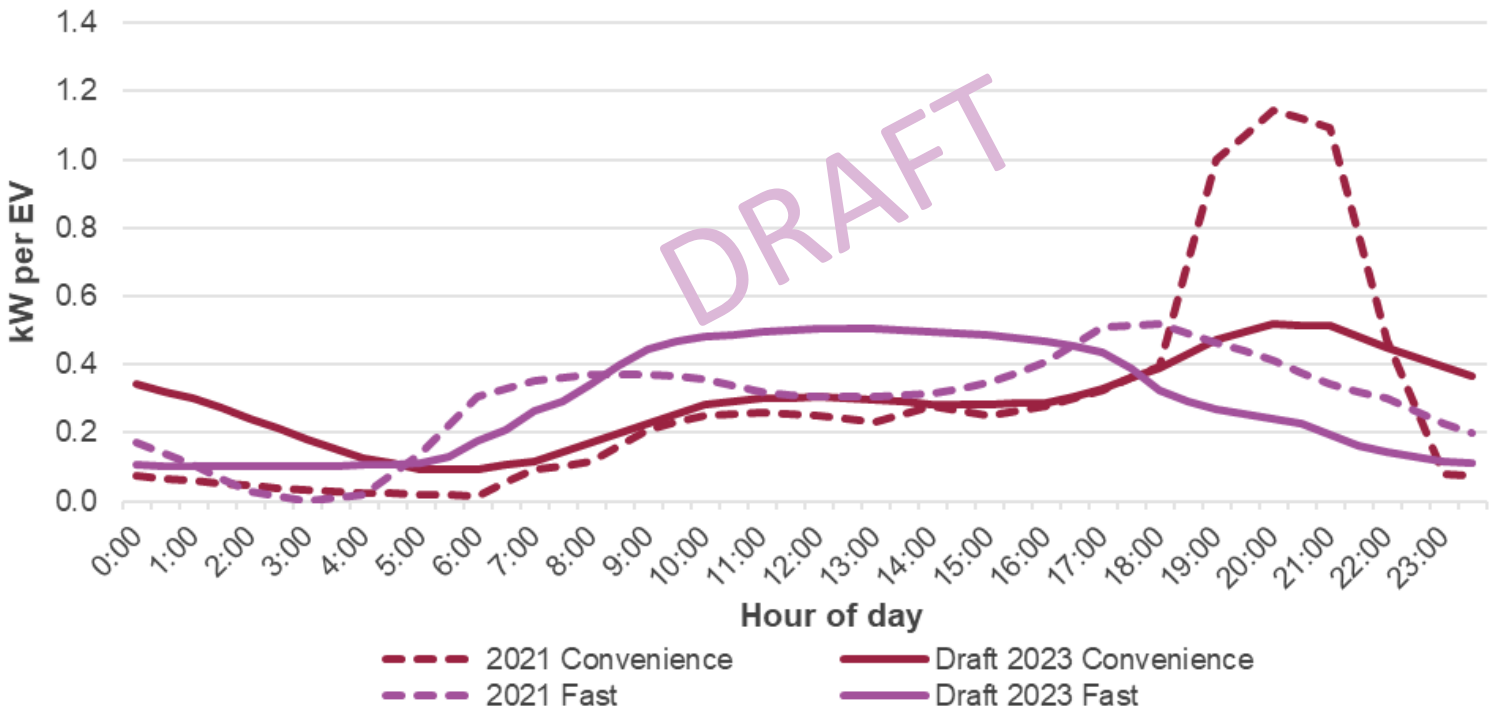


★ i.e. in NSW, WDR was activated in 55% of price intervals between $10,000-15,000/MWh, whilst Victorian WDR was 30% for price intervals in that range

★★ WDR was activated significantly less frequently at lower price levels

EV charging profiles updated from new data

Example: Medium-sized residential EVs move to flatter charging profiles



Normalized after diversity EV charging profiles (medium-sized residential EVs in Victoria based on a typical January weekday, 2030, 1.8°C Orchestrated Step Change scenario)

Data sourced from publicly available reports: Energex and Ergon Energy Network's EV SmartCharge (Queensland) program, Origin Energy, ARENA, EA Technology (UK).

Fast-charging: Traffic movements, which served as a proxy for public charging behavior, showed two peaks in 2021. In 2023, public charging behavior is based on a study of public fast charger meter data, which revealed a flatter peak over the day.

Convenience charging: A lower charging peak is assumed for 2023 as new trial data indicates dedicated high-power chargers are less common than previously believed.

*The above two changes affect all residential charging profiles

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