2020 Forecast Improvement Plan

Progress update

28 July 2021 FRG Meeting

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Background and Purpose

This presentation provides an update on the 2020 Forecast Improvement Plan (FIP)

Engagement timeline

Timing	Details
Nov 2020	Draft 2020 Forecast Accuracy Report and Forecast Improvement Plan FRG presentation
Dec 2020	2020 Forecast Accuracy Report and Forecast Improvement Plan published
Feb 2021	Final 2020 Forecast Improvement Plan published
Today	**2020 FIP progress update**
Oct 2021	2021 FAR

Today's agenda:

- 2020 FIP summary
- Stakeholder engagement
- Update on initiatives:
  1. PV forecast improvements
  2. Data analytics to improve understanding of trends and drivers
  3. Improved maximum demand outcomes in demand traces
  4. Emerging technologies
  5. Improved wind generation traces accounting for high temp cut-offs
  6. Improve modelling of inter-regional transmission element outage risk

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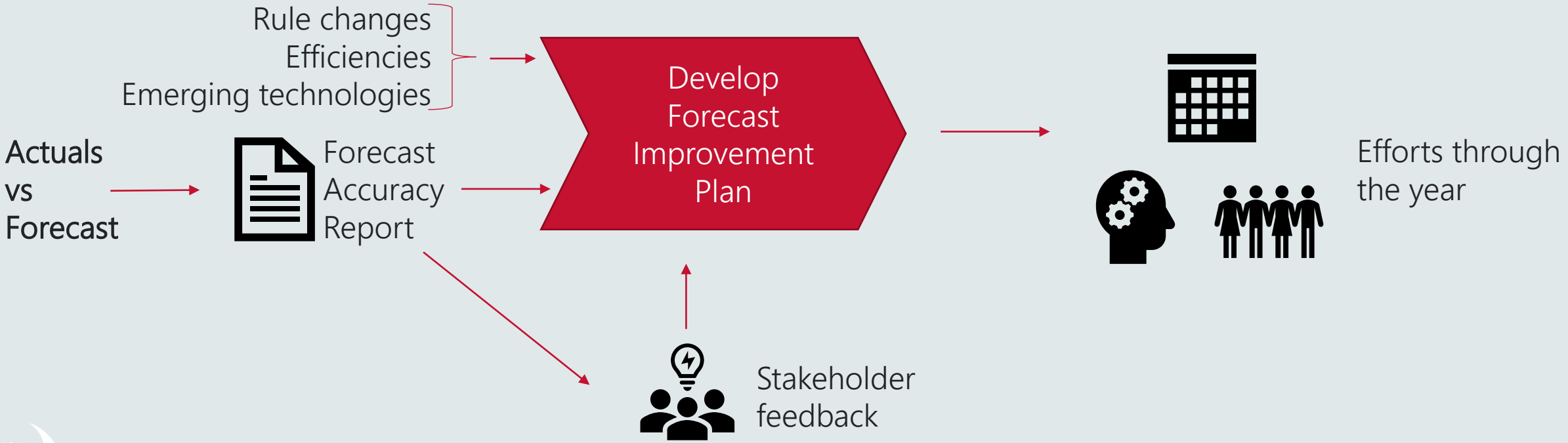
The Forecast Improvement Plan guides AEMO's ongoing technical improvements

Reliability Forecasting Guidelines – accuracy and fit for purpose of Reliability Forecast

Forecasting Best Practice Guidelines – stakeholder engagement

Forecasting Approach – logical layout of Forecasting Components



Recap

The 2020 FIP benefitted from stakeholder feedback

Draft Forecast Improvement Plan (Dec 20):

1. Improve PV forecasts to minimize adverse impacts on consumption, demand, reliability and system security outcomes.
2. Gain increased visibility and understanding of consumption drivers and trends through data analytics to improve forecast accuracy and improve the ability to explain forecast variance.
3. Better represent the forecast distribution of monthly maximum demand outcomes.
4. Develop improved wind generation traces accounting for temperature cut-offs.
5. Improve modelling of inter-regional transmission element outage risk.

AEMO received three submissions, covering:

- Inter-regional transmission elements.
- The inter-regional transmission element forced outage rate model.
- The forecast impacts of battery storage systems and electric vehicles (EVs).

The final FIP (Feb 21) included a sixth item:

6. Improve understanding of emerging technologies such as battery storage and EVs.

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Solid progress against the Plan

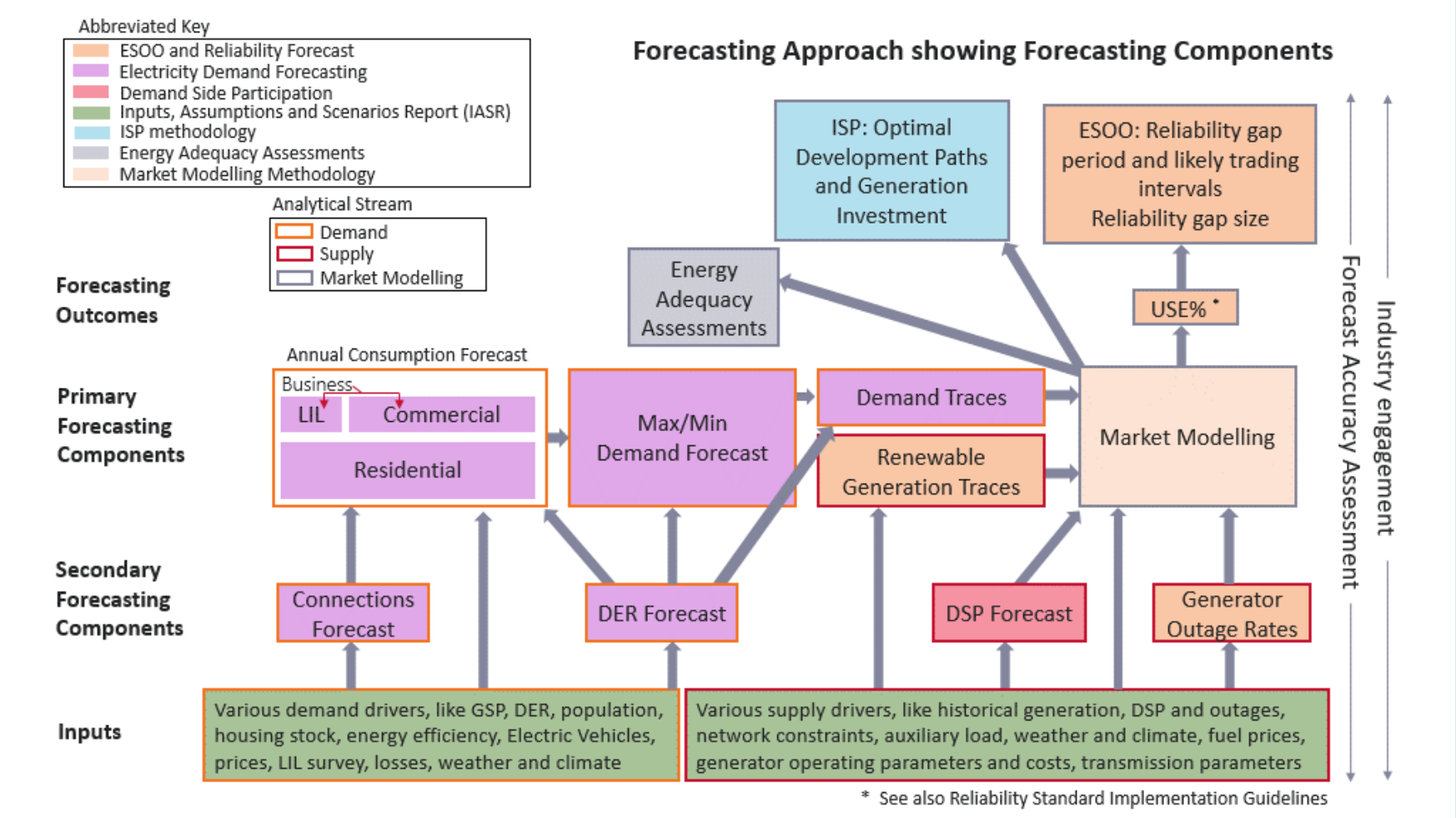
Initiative	Status	Commentary
1 Improved PV forecasts through better visibility of installed capacity and short-term trends	Implemented	AEMO has monitored CER and DER-Register data accuracy. Reduced lag has improved estimate of current capacity which helps projecting better short-term trends.
2 Data analytics to improve understanding of trends and drivers	Mostly progressed	Smart meter data analysis has improved the split of residential and business load for the 2021 ESOO, and improved understanding of the (lack of) COVID-19 impacts on max/min demand.
3 Improve representation of the monthly max demand forecast distribution	Partly progressed	Progressed building blocks to enable better traces for shoulder season. Progressed synthetic traces as an alternative approach.
4 Improved wind generation traces accounting for high wind and high temperature cut-offs	Implemented	Improved wind traces developed for the 2021 ESOO. The traces will be published with the 2021 ESOO dataset - trace library.
5 Improve modelling of inter-regional transmission element outage risk	Implemented	Weather driven outage rate traces were created for select transmission elements. See presentation 1 of the 30 June 2021 FRG.
6 Improved understanding of uptake and use of emerging technologies	Progressed	Improved battery storage data in the DER-Register. Developed capability to identify battery storages (and other appliances) from smart meter data. Working with industry to understand EV uptake impacts.

Discussion

Reminder: Stakeholders will be consulted on the FIP when the FAR is published.

Do the presented initiative areas remain as priorities for further improvement, or are there emerging areas of higher importance?

Which areas of the Forecasting Approach do you see as FIP opportunities?



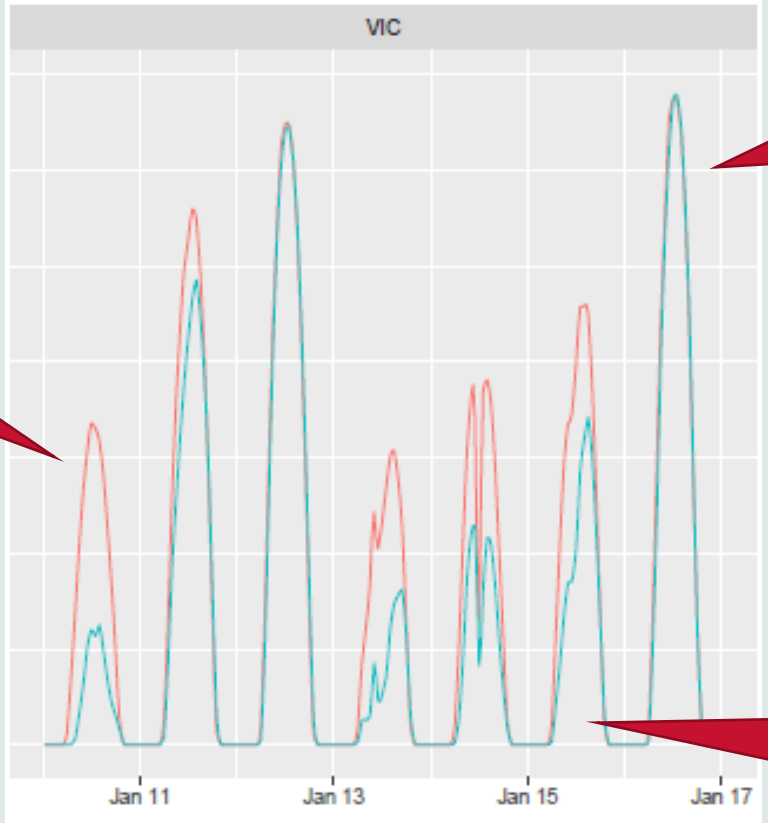
Appendix - initiatives

Initiative 1 – Improved PV forecasts

- In the 2020 FIP, AEMO flagged the following potential improvements in its PV forecasts:
  - Improved visibility of installed capacity by using the newly developed DER Register either for validation or as a primary data source, reducing the potential lag time that exists with the current Clean Energy Regulator (CER) data stream.
  - Increased analysis and consideration of short-term installation trends, particularly if the trend has exhibited non-linear features.
  - Review of Solcast's normalised PV generation profiles, used to ensure the forecast generation per MW of installed PV capacity is within expectation when used to offset the consumption forecast as well as at time of maximum and minimum demand.
- What AEMO has done:
  - Assessed quality of CER data, including use of DER-Register data for validation. Improved recency of data (less lag between PV installations and registering by CER) has been observed leading to an improvement in the estimation of current capacity.
  - Increased usage of actual data in preference to estimated data.
  - Updated normalised PV generation profiles – now leverages improvements in satellite data and cloud/aerosol modelling.
- Additional initiatives not listed in the FIP:
  - Changed how CER data is split into residential and business PV systems, using 15 kW as cut-off point rather than the previous 10 kW threshold. This is consistent with how CER is reporting it – and better reflects the increase in size of some residential installation.
  - Improved automation – less manual handling of consultancy data, more time for QA.
- Next steps:
  - Continue to monitor accuracy of CER and DER-Register data, and see if investment in PV slows down as COVID restrictions are lifted.

Updated normalised PV generation profiles better capture outputs on partially sunny days

Victoria, week of January 2015



Source: AEMO analysis of Solcast profile

Improved cloud/aerosol modelling has reduced estimated generation on cloudy/partly cloudy days

Update has no impact on sunny days, so there has been no impact on the forecast minimum demand.

At time of typical maximum demand, the update has no significant impact on the outcomes.

Previous profile
Updated profile

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Initiative 2 – Data analytics to increase visibility of consumption drivers and trends

- In the 2020 FIP, AEMO flagged the following data analytics work to improve its understanding of consumption and demand drivers:
  - Help verify the models for residential and business consumption and have them based on the last year of estimated actuals rather than AER data that is currently used, and may be 18 months old. This should improve model performance and validation.
  - Improve the ability to explain forecast differences by increasing the understanding of sectoral or spatial trends, such as COVID-19 impacts that may differ across NEM regions.
  - Improve understanding of variability of large industrial loads at time of minimum demand events.
- What AEMO has done:
  - Improved the estimate of residential/business consumption split for ESOO 2021 based on sample smart meter data to supplement the AER split in a hybrid approach.
  - Continued analysis of COVID-19 showed little evidence of impact at time of max and min demand (see max/min demand FRG presentation from early July).
  - Improved representation of LIL at time of minimum demand and addressed data gaps in the LIL data affecting this.
- Additional initiatives not listed in the FIP:
  - Improved understanding multi-sector couplings, sectorial energy intensity trends including impacts of energy efficiency (EE), e.g. though the EE workshop.
  - Metering analysis of data centre load growth – confirming this is following a linear trend rather than a step change.
- Next steps:
  - Seek to work with DISER to improve Australian Energy Statistics Table F to increase understanding of business sub-sector consumption and the ability of AEMO, its consultants and other stakeholders to use that within integrated assessment models.
  - Further improvements in residential/business split expected from MSATS Standing Data Review and Global settlement.

Initiative 3 – Improve representation of the monthly max demand forecast distribution

- In the 2020 FIP:
  - AEMO noted examples of where monthly MT PASA traces reported in the FAR showed cases where actuals in shoulder seasons fell outside the range spanned by the reference years used. This is because the traces represent history (last nine years) rather than the forecast outcomes.
  - AEMO should explore ways to better capture the range of maximum monthly demand outcomes across the sample of traces used. The approach used to develop the 10% POE daily peak load, and the most probable daily peak load forecasts published in the MT PASA process should also be reviewed.

- What AEMO has done:
  - Explored options to improve the shoulder seasons trace outcomes. Use of historical demand traces stretched to hit more targets would cause increasing distortion of the load shapes. Instead, AEMO has found that the issue is best addressed through use of synthetic demand traces. These are expected to improve shoulder season accuracy as model based (reflecting forecast drivers), rather than history based.
  - Considered options for improving the 10% POE daily peak load, and the most probable daily peak load forecasts. This may best be done through publishing POEs that represents monthly POEs rather than seasonal POEs. AEMO will consult on this change in its next FIP.

- Additional initiatives not listed in the FIP:
  - None.

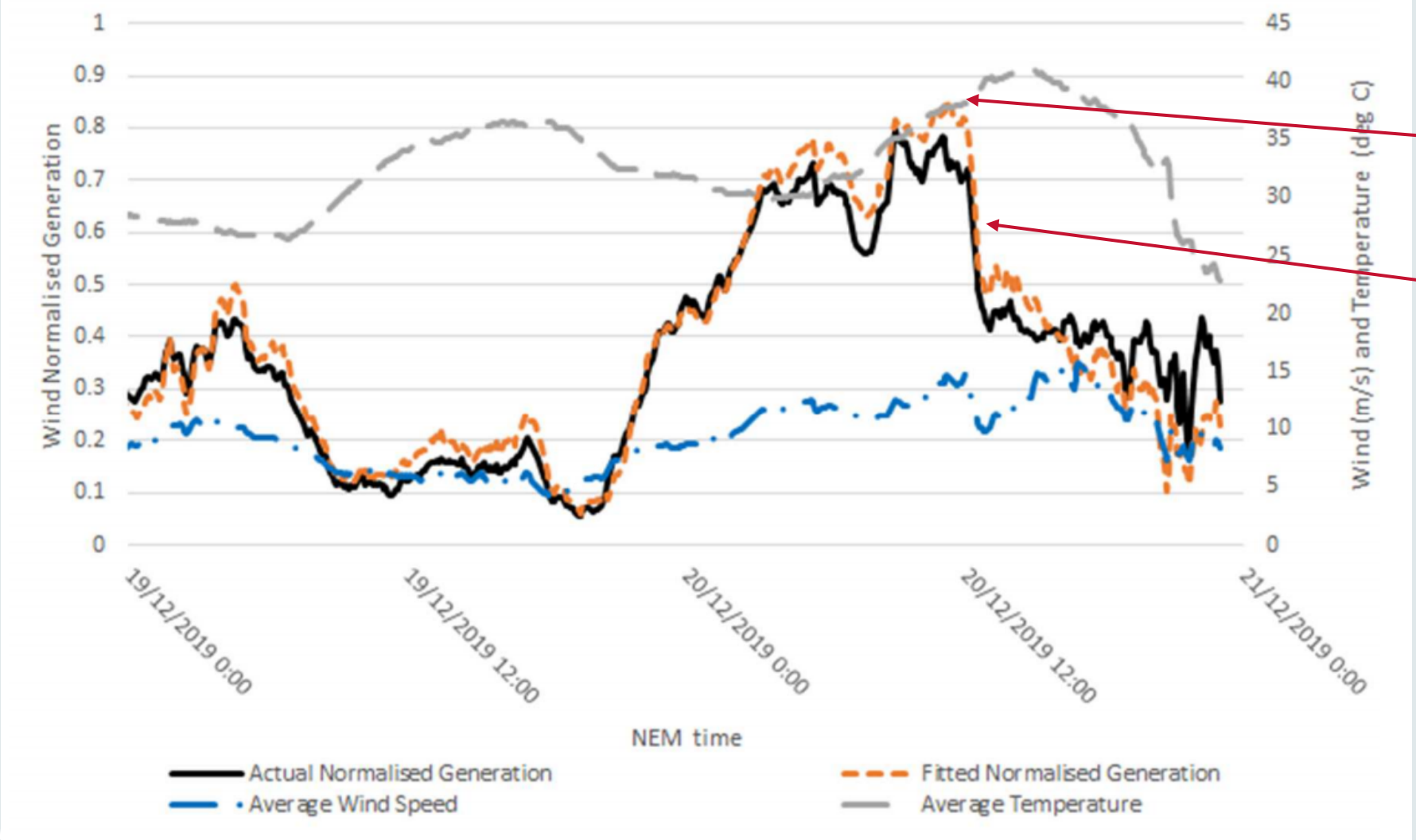
- Next steps:
  - Continue work on synthetic demand traces. To be reported on in a future FRG and actual implementation/use consulted on before use.
  - AEMO will also consult on suggested changes to the 10% POE daily peak load, and the most probable daily peak load forecasts.

Initiative 4 – Improved wind generation traces accounting for wind/temperature cut-offs

- In the 2020 FIP:
  - AEMO noted it increasingly relies on empirical wind generation profiles rather than historical wind generation data as inputs into its modelling. These profiles reflected a simple wind speed to generation relationship only, and did not capture any potential cut-off in response to high wind speeds or the wind turbines safe temperature thresholds being exceeded.
  - As a result, AEMO intended to develop and implement a new wind generation model that will produce more realistic traces in the presence of high temperatures or wind speeds.
- What AEMO has done:
  - Developed an empirical machine-learning based wind generation model, which accounts for both high wind and high temperature cut-offs in its calculation of half-hourly wind generation. If participants provided specific temperatures thresholds through the Generation Information process, the approach would account for those.
- Additional initiatives not listed in the FIP:
  - None
- Next steps:
  - AEMO will continue to review the performance of its wind profiles. The ESOO and Reliability Forecast Methodology will reflect the updated approach when published.

Initiative 4 – Improved wind generation traces account for wind/temperature cut-offs

Prototype of the implemented approach – showing the impact for a high temperature day



Temperature rises (grey), causing modelled Wind Generation (orange) to drop, closely matching actual Wind Generation (black)

Initiative 5 – Improve modelling of inter-regional transmission element outage risk

- In the 2020 FIP:
  - AEMO noted its current method for capturing inter-regional transmission element outage risk as appropriate for random outages but also that it may not adequately capture trends in frequency or timing/coincidence when the outages are driven by weather, such as heat waves increasing risk of bush fires.
  - In response, AEMO intended to develop and implement new transmission failure models, that predict failure as a function of weather, where relevant.
- What AEMO has done:
  - Developed a methodology to model forced outages as a function of bushfire weather, for the Dederang-South Morang and Dederang-Upper/Lower Tumut lines, as described in the June 2021 FRG.
- Additional initiatives not listed in the FIP:
  - Calculated transmission outage rates relevant for the weather dependent method, as presented in the June 2021 FRG. As with other Forced Outages Rates (FOR), these values will be consulted on annually. The outcomes of the feedback received to the FOR presented in June will be published in the IASR on 30 July.
- Next steps:
  - The ESOO and Reliability Forecast Methodology will reflect the updated approach when published.

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Initiative 6 – Improved understanding of emerging technologies

- In the 2020 FIP, AEMO flagged the following work to improve understanding of current uptake and use of emerging technologies:
  - Improve visibility of existing battery storage installations, through enhancements to data in the DER Register and development of detection algorithms that can identify battery storage from metering data series.
  - For EVs, AEMO will engage with industry to build and share knowledge on EVs, including through its role in the Distributed Energy Integration Program (DEIP).

- What AEMO has done for better data on existing battery storage installations:
  - Worked with distribution network service providers (DNSPs) to improve the quality of data in the DER-Register.
  - Developed (with CSIRO in the NEAR program) prototype methodologies to identify battery installations from metering data along with their operating profiles. This can potentially help identify unknown battery storage installations. This capability can be used to identify other appliances, such as EVs, in the future.

- What AEMO has done for improved understanding of EV uptake and use:
  - Continued leading the EV Data Availability Taskforce under the Distributed Energy Integration Program (DEIP) Electric Vehicle Grid Integration Working Group, and is continuing to engage with industry (as reported in the EV presentation in this FRG).
  - Completed analysis of fast charging/highway charging profiles based on smart meter data for 160+ fast/super-charging stations.

- Additional initiatives not listed in the FIP:
  - In the 2021 ESOO and 2021 Inputs, Assumptions and Scenarios Report (IASR), AEMO has included modelling of the hydrogen sector and generally reflected the results of multi-sector coupling through integrated assessment models (IAM).

- Next steps:
  - AEMO has contracted with a consortium of universities led by University of Melbourne, for a review of its forecasting methodologies, including whether it will continue to be fit-for-purpose in future as new technologies emerge.