

MINUTES

MEETING: ST PASA Replacement Project Workshop #4 – Uncertainty Margins and Demand Forecasting for ST PASA

DATE: Thursday, 21 July 2022

TIME: 10:00am-1:00pm AEST

LOCATION: Microsoft Teams Meeting only

TELECONFERENCE DETAILS: **Join on your computer or mobile app**
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[+61 2 8318 0090,,26252445#](tel:+6128318009026252445) Australia, Sydney
 Phone Conference ID: 262 524 45#

EXTERNAL ATTENDEES:

ORGANISATION REPRESENTED
AEMC
AER
AGL
Alinta Energy
CS Energy
Department of Environment, Land, Water and Planning (DELWP)
Energy Australia
Energy One
Flow Power
Global ROAM
Hydro Tasmania
IESS
Intergen
Minter Ellison
Origin Energy
Overwatch Energy
Pacific Energy Trading
Powercor
RM Hedge
Shell Energy
Stanwell
SWA Advisory

Agenda:

No.	Time	Agenda item	Responsible
1.	10:00 am – 10:05 am	Welcome and Introductions	Paul Johnson Chair
2.	10:05 am – 10:35 am	Defining Uncertainty	Jack Fox AEMO - OPERATION
3.	10:35 am – 11:05 am	Uncertainty Margins	Jack Fox AEMO - OPERATION
4.	11:05 am – 11:35 am	Modelling Uncertainty Margins	Steven Disano AEMO - OPERATION
5.	11:35 am – 11:55 am	Demand Forecasting for STPASA	Andrew Akman AEMO - OPERATION
6.	11:55 am – 12:25 pm	Validating the system and Consultation	Jack Fox AEMO - OPERATION
7.	12:25pm – 12:35 pm	Data to be published	Jack Fox AEMO - Operations
8.	12:35 pm – 12:40 pm	Next Steps, Project timeline	Shivani Mathur AEMO - OPERATION
9.	12:40 pm – 1:00 pm	Q & A (any further feedback)	Shivani Mathur AEMO - OPERATION

Item #1: Welcome and Introduction – Chair – Paul Johnson (AEMO)

The chair welcomed and informed the attendees that:

- Notes will be taken, and a summary circulated after the session.
- Participants are not permitted to record the meeting. Unauthorised recording is likely to break a number of state and federal laws.

Item #2: Defining Uncertainty – Jack Fox (AEMO)

Slides 5 to 16 from the slide pack were discussed. This included the definitions of Uncertainty and the metric used as well as information on the high-level design (HLD) to account for uncertainty in ST PASA.

Key discussion points were:

- A question was raised by Shell on whether the data or graphs are available for the key peak demand periods only.
 - AEMO's response was that AEMO had not undertaken this exercise yet, however that data could be provided by segmenting the top 5% or 10% of the demand.
- A comment was raised by Shell relating to slide 13 on whether analysis undertaken for wind and solar would show increased or decreased uncertainty for these fuel types, after correcting for increased availability (installed capacity) trend, in comparison to coal.
 - AEMO's response was that analysis was undertaken on wind and solar, and that we could provide this information after this workshop.
- A question was raised by Flow Power in relation to slides 12 and 13 on how the uncertainty level varies across different time periods of a day.
 - AEMO responded that this would be discussed in more detail later in the workshop, however demand uncertainty does vary across a day due to increase in temperature variation and uncertainty during daylight hours and also the impact of distributed PV (cloud) which varies faster and more materially than temperature variations.
- A follow-on question from Shell was whether this suggested that there should be at least separate daylight and non-daylight period margins calculated and if uncertainty levels change as PV output varies across a day.
 - AEMO responded that AEMO's proposed approach was dynamic and granular enough to take into account such proposed temporal and resource-based variations.
- Shell followed this response up with whether the confidence level would be varied e.g. to 90% or will it be implemented as a fixed 95%
 - AEMO responded that 95% has been selected for the purposes of modelling and that as the confidence level is a critical element, it will be determined through a consultation with stakeholders once results are obtained. AEMO will be seeking stakeholder input on the confidence levels.
- A comment was raised by Shell in relation to slide 16 that the probabilistic approach using Uncertainty Margins (UM) is similar to the approach applied in the FUM
 - AEMO agreed that the FUM's probabilistic approach is similar to that used for UM however the implementation is different as the FUM is a post-processing approach whereas the UM will be an input to the optimiser.
 - Shell asked a follow-up question on whether there is a difference between input vs output.

- AEMO responded that it does make a difference, and this would be explained later in the workshop.
- Also, in relation to slide 16, Shell raised a question about the monte-carlo simulations and whether AEMO had considered an approach similar to the FUM where uncertainties are already taken into account, rather than attempting in real-time
 - AEMO acknowledged it was a good suggestion however that approach may not be as dynamic as the system changes which is a benefit of modelling UM. Monte-Carlo would require recomputing distributions being used regularly, as the dynamics of the system change for example how the fleet composition is changing.
 - Stephen Wallace further added that difficulty with Monte-Carlo simulations lies with the design of the SCED which has a full network model and it would be impossible to run e.g. hundred thousands of schedules i.e. it isn't just about the margins, but they do have to be applied into a model.

Item #3: Uncertainty Margins – Jack Fox (AEMO)

Slides 17 to 28 from the slide pack were discussed. This included explanations on how the Uncertainty Margins and Confidence Levels are used and showed an example on applying Uncertainty Margins to the model.

- A question was raised by Shell relating to slide 18 on the impact on network capability from adding the UM to the demand at each bus and the resultant potential to over specify what may be needed at that bus.
 - AEMO acknowledged that there is potential for this to occur, and results will need to be assessed once AEMO has run the example through a SCED system. One thing AEMO has flagged is that for industrial load at a bus, there may need to be a capped amount so that the forecast of industrial load plus UM shouldn't exceed physical network capability to supply that load.
- Another question from Shell related to whether there is a large difference between costs associated with a full network model and the costs associated with a zonal model that is more granular than the regional model AEMO currently has.
 - Stephen Wallace responded that a full network model is expected to be much cheaper as AEMO already has the full network model developed and maintained for its EMS. AEMO also already develop generic network constraints based on the full network. A sub-zonal model would require another model to be developed and maintained and another set of generic constraints to be developed and maintained.
 - AEMO also added that we currently use a full network model for automatic constraints.
- Clarification was sought from Global ROAM relating to slide 25 where step 5 includes a cap for scaling the uncertainties and whether that cap was for the regional total for uncertainty.

- AEMO responded that the total uncertainty in the example is a total regional uncertainty.
- Additionally, a further question was raised from Global ROAM on the materiality if this is applied to generators, where generator uncertainties are driven by one or two generators that operate from full availability to no availability and therefore potentially smear the uncertainty across all generators.
- AEMO responded that the potential for 'smearing' will depend on the confidence levels and once backcast results are obtained the impact of different confidence levels can be observed, there will be a better understanding on this situation.
- The AEMC asked whether AEMO has considered the treatment of UM on the supply side and demand side, since Monte-Carlo simulations are too complex to run.
 - AEMO responded that this has been taken into account by using actual total demand minus supply uncertainty to calculate the total regional UM in step 1 of the UM example.

Item #4 – Uncertainty Margin modelling – Steve Disano (AEMO)

Slides 29 to 35 from the slide pack were discussed. These slides included an overview of the UM modelling and showed some results using a 95% confidence level. The slides also highlighted the differences between the current FUM approach and the future UM approach.

Key discussion points were:

- Shell sought clarification on slide 32 that the 'day ahead' forecast related to a 24 hours ahead snapshot at any particular time, i.e., it was not reflective of the 24 hours ahead pre-dispatch forecast.
 - AEMO confirmed Shell was correct and that 'day ahead' refers to a sequence of 24 hour ahead forecasts, and explained that the graph showed that the model is more certain on the hour ahead forecast than at the 7 day ahead forecast.
- Shell sought clarification on the graph on slide 34 on negative error levels and whether this means there has been an under-forecast i.e., the forecast was too low than actual.
 - AEMO confirmed Shell was correct in its understanding.
- Shell asked a further question on why a negative UM is allocated.
 - AEMO responded that the model is only predicting at the 95th percentile which will generally only be a positive number prediction however the 95th percentile may change once we get results to see what confidence levels result in an approximate of the reliability standard unserved energy (USE) metric.

- Shell cautioned AEMO on its use of the reliability standard metric which applies to regional generation and interconnector flow paths, and does not apply to the loss of inter-regional lines and subsequent involuntary load shedding.
 - AEMO acknowledged this point made by Shell.
- Shell made a comment relating to slide 35 and the fact that the FUM methodology or the NER does not restrict AEMO on calculating the FUM based on individual VRE forecast uncertainty and adding them together to create a regional uncertainty.
 - Stephen Wallace commented that there are major problems statistically when calculating UM by adding them up as the resultant total is too large due to diversity associated with negative and positive correlations.
 - Shell clarified that differences being quoted on slide 35 between FUM and UM are all a creation of the methodology and are not restrictions or requirements on AEMO.
 - AEMO clarified that the intention of slide 35 was to highlight the difference between the current approach of the FUM and the future approach of the UM (i.e. taking into account the UM as an input rather than post-processing) and therefore the process of calculating reserve will be different in the new system.
- Energy Australia commented (in relation to the differences between the current FUM approach and future UM approach) that the new approach appears less conservative in some regards from a VRE uncertainty perspective. The approach is at the nodal level and takes into account that there are generators behind constraints and any under-delivery may be less impactful if they are already capacity constrained.
- Energy Australia asked a question about the UM approach accounting for individual scheduled generator Maximum Availability uncertainty and whether this factor will incorporate some of the expected generator response and therefore 'cancel out' other generator's uncertainties.
 - AEMO responded that the approach will consider each generator's Maximum Availability submission would go into the uncertainty modelling and the generator would then get a portion of the regional uncertainty. It would also depend on the confidence level used and the impact of which will be better explained through results once the backcast run has been completed.

Item #5: Demand Forecasting for ST PASA – Andrew Akman (AEMO)

Slides 36 to 42 from the slide pack were discussed. These slides included discussion on the requirement of a nodal load forecast for the full network model and the challenges and characteristics associated with this.

- No questions were raised relating to this topic.

Item #6: Validating the System and Consultation – Jack Fox (AEMO)

Slides 43 to 50 from the slide pack were discussed. These slides included an explanation on the process and timing for validation, including information on the back cast methodology to be applied. Information on AEMO's formal consultation process to commence in late 2022/early 2023 was also provided.

Key discussion points were:

- CS Energy raised a question relating to slide 48 and the granularity that AEMO is looking at in terms of time intervals for the ST PASA forecast horizon, noting that the accuracy of the forecasts and confidence levels is important in determining the latest time to intervene (LTTI).
 - AEMO responded that we are designing the system to be flexible so that confidence levels can vary for any interval for the horizon. Also, in determining the LTTI, this will be on a case-by-case basis and is likely to change going into the future as the fleet evolves.
 - CS Energy added that with the USE metric being a rolling 12 month one, there could be some challenges in reconciling that metric to the relationship with the uncertainty level.
 - AEMO responded that we should be able to roll that USE metric through and align the analysis with the metric.
 - AEMO further noted that under the deterministic approach to forecasting PASA assessments, there is currently a lot of uncertainty that is masked. However what AEMO is attempting to achieve is quantification of variability and uncertainty as there are changes over time to e.g., the fleet, levels of uncertainty and changes to market structures. Therefore, is it important that we don't constrict the timeframes that are considered.
- Shell commented on slide 48 in that this is going to be a progressive presentation of information as per the current system, e.g. flagging shortfall in an area/specific node and agreed that confidence levels are important and could create bias in the outcome therefore industry doesn't want a worsening of alerts from the proposed change.
 - AEMO highlighted that uncertainties are real but don't always eventuate, however the important point to note is that the LTTI is likely to change as the fleet composition evolves.
- Shell raised a question regarding whether the proof-of-concept (POC) modelling would be occurring at the same time as the formal consultation process (slide 49).
 - AEMO confirmed that the consultation process would be related to the methodology but not on the confidence levels. Another round of consultation would occur in 2024 or 2025 to determine the confidence levels at which point the results of the backcasting would be available to share.
 - Shell further raised a concern on the consultation of the methodology ahead of results being available and asked if examples could be made available during the consultation on the methodology. For example, could AEMO

provide results for one week (e.g., biggest demand week in the last 5 years) rather than a 5-year period as the more detail stakeholders have to inform their feedback during the consultation process the more beneficial the process would be.

- AEMO clarified that there are NER timing requirements with the Rules Consultation Procedure and that until we have finalised documentation we can't finalise the design for the new system, and until we can finalise the design we can't integrate and implement for the back casting to then occur. Therefore, AEMO is trying to find the best way forward in this circumstance.

AEMO also added that any examples included in the consultation would only contain mock data and while we could provide some indicative results for UM models and load forecast for one week, there would not be any end-to-end results with that i.e., the load deficits for that week from the SCED.

- CS Energy echoed Shell's concerns that in absence of back cast results, consultation may end up with more questions than answers requiring further iterations of consultation.
- AEMO highlighted that while the process appears to be going into an area of ambiguity and uncertainty, decisions will only be made from effective engagement that do not infer too much risk.

Item #7: Data to be published – Jack Fox (AEMO)

Slides 51 and 52 from the slide pack were discussed. These slides included information on data that AEMO intends to publish after each run of ST PASA and also asked stakeholders on other data that they would like to see published.

- A question was raised by Global ROAM relating to slide 52 about the ST PASA solver and whether the most likely (e.g., 50% POE) load forecast would be available.
 - AEMO responded that the raw load forecast would be published i.e., the 50% POE load forecast without UM added on.
- Shell also asked a question on slide 52 on whether the original load forecast would be published and would it be a 50% POE forecast and the UM forecast.
 - AEMO responded that the original load forecast would be published as would the UM i.e., before and after the scaling is applied and that we aren't proposing to change anything else that is currently published with respect to the 10%, 50% and 90% POE operational demand forecasts.
- Shell also asked if a 50% POE load forecast with a 50% confidence level would be published at the regional level.
 - AEMO responded that this could be considered and discussed further in the next workshop on PASA run types.

- Stephen Wallace commented that this would be a good sanity check to include
- Global ROAM raised a question about confidentiality concerns for industrial loads on buses
 - AEMO responded that we will need to confirm with the legal team around confidential data however we aren't intending to publish the actual loads for each bus until the next day.

Frequently asked questions (FAQs) – Jack Fox (AEMO)

Slides 56 to 58 were discussed. These slides included AEMO responses to questions from previous workshops that were taken on notice.

- CS Energy asked for clarification on slide 56 relating to not using PASA Avail for modelling purposes as it is an important term and gives full insight to capability.
 - AEMO confirmed that this was just for the modelling of the UM for scheduled generators and not that the ST PASA won't take into account PASA Availability. Another run will take into account PASA Avail instead of Maximum Availability for extra information, which would be detailed in the Run Types workshop (workshop 3).
- Energy Australia commented on slide 57 that opportunistic outages could be taken more frequently and therefore wise to quarantine those so that they don't contribute to the UM. Shell supported this point.
 - AEMO acknowledged this point and reiterated that AEMO is looking at ways of filtering Maximum Availability training data so that e.g., opportunistic behaviours can be picked up. AEMO also highlighted that generators could assist by providing better rebid reasons.
 - It was suggested by Energy Australia to include additional/required information as part of the recall time.
- A comment was raised by Shell relating to slide 58 that AEMO running a n-1 contingency run for the loss of a generator and then restricting other generators to their Maximum Availability with a 95% confidence level appears to be overly conservative.
 - AEMO clarified that the 95% confidence level is the UM and is not an additional factor.
 - Stephen Wallace highlighted that the n-1 run is largely designed to run the power system in a secure manner rather than reliability.
 - Shell then asked for confirmation that the n-1 contingency run would not be used in the reliability assessment.
 - Stephen Wallace responded that security needs to be managed first before a reliable power system can be achieved and the security constrained economic

dispatch automatically requires a n-1 contingency. A secure operating regime will be achieved prior to the reliability assessment.

- AEMO clarified that a n-1 contingency run will be undertaken when performing the LOR runs and will use the UMs on other generators.
- CS Energy asked for clarification on what AEMO would be reporting to the market from this run.
- AEMO responded that load deficits at each load bus aggregated at certain levels would be reported. AEMO also added that this run and other PASA runs will be further explained in the next workshop on PASA run types.