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(Lodged electronically) 14 February 2020

AEMC Primary Frequency Response Rule Changes (Ref. ERC0274 and ERC0277)
Draft Determination 19 December 2019

Delta Electricity operates the Vales Point Power Station situated at the southern end of Lake Macquarie in NSW. The power station consists of two 660MW conventional coal-fired steam turbo-generators. Delta Electricity appreciates the opportunity to comment on the Draft Determination.

Final Determination Outcomes

Delta Electricity supports a final determination that seeks to rapidly address the concerns raised about system security that prompts AEMC to finally determine for the mandatory Rules. Removal of the concerns around system security should be the priority of these Rules that are expected to have temporary existence. The temporary arrangements will be more rapidly implemented if the determination can ensure that AEMO's draft Primary Frequency Response Requirements (PFRR) more simply seeks tighter deadbands adopted on existing controllers and encourages but does not enforce other parameters presently included in the draft PFRR. On existing controllers, "as-found" existing capability on parameters other than deadband should be permitted in preference to rigid adherence in the interest of more rapid deployment and in order to avoid significantly delaying the required level of improvements required to remove the threat to system security.

Any delays in a rapid roll-out of tighter deadband control possibly represents an increased threat to system security that the proponents are concerned about.

Delta Electricity also greatly appreciates the AEMC vision and supports the assignment of a "sunset" on the to-be-determined Rules and looks forward to the separate development of a more practical and efficient market solution as envisaged by the AEMC. It is in development to meet the future market solution that Delta Electricity would prefer to apply its attention and development budgets.

Frequency Performance against the Frequency Operating Standard (FOS)

Following deployment through 2019 into early 2020 of adjustments to existing AEMO controls on frequency performance, are the system security concerns raised by AEMO and others remaining valid? Delta Electricity encourages the AEMC to revisit the data, trends and reports that first demonstrated that risks to system security exist. The latest reports from the Operator should be obtained and examined closely and possibly included in the final determination for reference. It is noted that the latest published AEMO Frequency and Time error report at time of drafting this letter is Quarter 3 2019 (July to August 2019). It is unfortunate that in lead up to the final determination of these Rules, the Quarter 4 report is not yet available from AEMO and that there is likely also to be no preliminary report from the operator on the conditions as experienced over January 2020 in direct comparison to January 2019 when performance was at its worst in recent times.

However, in case it is of interest to the AEMC in its final determination considerations, Delta Electricity maintains independently produced trends of frequency performance (see Attachment 1). These trends, as indicated in event counts and time experienced outside the NOFB, display that significant improvements in system frequency performance has occurred following AEMO actions to raise the minimum Regulation FCAS quantities between March and May 2019. Additionally, reductions in the Load Relief[1] percentage from September 2019 to January 2020 appear also to have contributed to improvements.

The Rule changes were proposed before performance improvements from existing adjustments available to AEMO had been assessed and before other performance improvement activities AEMO pursued had been completed. System frequency appears to remain compliant with the FOS although there were periods early in 2019 when arguably this was not so. How is the performance today? It is suggested that the most up to date performance trends should be obtained and referenced in the final determination. Such performance trends are principal performance indicators to be included in discussions, generate future targeted improvement trajectories, and steer work programs the mandatory rules will govern. Without statistically accurate and consistently produced trends of performance it may not be clear whether the rules are in fact achieving the objective that the proponents are seeking.

Does the AEMC consider there is any merit in AEMO exploring further changes to control mechanisms already available regardless of these new Rules? Delta's independently produced data possibly demonstrates the potential success of existing AEMO controls in maintaining frequency to FOS conditions. Have these existing controls yet been extended to the optimum level? It is hoped further improvements can be explored by AEMO using its existing controls and that the final determination agrees there is merit in this.

Frequency Performance within the NOFB and the Development of an Appropriate Standard for Frequency Quality

Delta agrees that frequency performance within the NOFB, or in particular frequency erraticism or potential of oscillatory behaviour within the bounds of the NOFB, should be the subject of future improvement and that the draft Rules are hoped to drive improvements in the short term. Delta considers that the quality of frequency control, and the subsequent market mechanisms to achieve it, should be set to meet an assigned standard that the NEM and its participants reasonably consider and determine is necessary to maintain. A future standard for the quality of frequency, developed with consideration of all market relevant parameters is required. The mandatory Rules potentially steer the market too far towards engineering excellence objectives without clear connection to the impacts on the market of a lesser standard. Whilst Rules of this type may promote simple and straightforward objectives for an operator they result in great additional expenses upon the bulk of participants in the NEM and therefore are not efficient. A standard of frequency quality developed to achieve sensible security and performance outcomes contained in a future review of the FOS is considered worthwhile. There will always be events that extend beyond the reasonable or predictable in their extent and impact but the power system cannot practicably or efficiently be designed and constructed to address every possibility.

Therefore, if the security concerns remain valid, presumably as a result of erraticism of frequency in the recorded levels within the NOFB, then the development of an appropriate standard for the quality of frequency to be included in the FOS remains a future mission recommended by Delta Electricity as an outcome of this determination or some other activity by the AEMC and the Reliability Panel.

[1] Factor that AEMO assumes in coordinating NEM response to contingency events

It is not yet clear what a suitable quality standard might be but Delta Electricity offers some samples of current frequency histograms (see attachment 2) as possible further indicators of current conditions.

Other Factors affecting Frequency Performance potentially not addressed by these Rules

As recognised by the AEMC, Delta Electricity maintains that other factors, and not simply reduction of PFR from existing machines, are also significant to frequency quality. The draft determination supporting AEMOs proposal to implement PFRR without including headroom is understood but Delta Electricity considers the NEM may eventually come to realise the necessity of readily available rapid frequency response capability. The capability will be required to be prepared with full awareness for when Units and the system are operated near maximum generator capacity or near minimum stable generator levels and for fluctuations that can occur anywhere in between these levels. Without the preparation of stored energy headroom (or reduction footroom), Delta Electricity does not expect that applied PFRR will fully address all variability and problems with frequency quality. It has been previously demonstrated from trends of published FCAS Contribution Factors that, collectively, intermittent generation causes the need for approximately five-times more regulation FCAS per installed MW than does more dependably dispatchable generation. Delta Electricity is of the opinion that the overall solution to frequency control of the interconnected AC networks in the NEM will not be achieved until it is recognised that all generation must either:

a. Preserve some energy and response capability for the provision of rapid PFR raise services and preserve response capability for rapid PFR lower services,

   OR

b. Be dispatched, from the AEMO AGC or otherwise, in a coordinated fashion in partnership with more dependable Generation that is able to rapidly adjust output to compensate for any sudden shortfall or excess Generation arising from the intermittent sources and less predictable weather related impact, to maintain a target the Operator dispatches for the coordinated partnership.

It is hoped the eventual market solution for delivery of PFR will appropriately compensate Generators for preserved energy responses required in part a) and that further market reforms find ways to consider part b).

Comments on the Implementation

1. Modification Costs for Existing Controllers

The aspect of greatest concern to Delta Electricity in the draft determination is that of the cost criteria AEMO will be empowered to consider in approving or rejecting exemption applications. The AEMC's decision to remove AEMO's proposal to compensate participants to meet the expectations of the draft PFRR is significant in this regard.

Delta Electricity encourages the AEMC to consider more carefully the wording of proposed Rule 4.4.2B(2) and its prompt as to costs relative to company turnover. The AEMC states[2] that plant upgrade costs are expected to be "relatively minor and manageable for most affected generators". Delta Electricity considers the meaning of such words is open to a variety of opinions. For example, Delta

[2] AEMC Primary Frequency Response Rule Changes (Ref. ERC0274 and ERC0277)
Draft Determination 19 December 2019 Summary point 19 page iv

Electricity considers that in order to be achieve the objective of the Rule, not necessarily all details of the PFRR, “relatively minor” costs will be incurred if local salaried staff are simply permitted to make slight adjustments to settings of existing frequency controllers (not design changes) to effect tighter frequency deadband responses. Adjustments to settings in existing control designs can be performed on in-service Units.

In contrast, more significant changes that require a participant to contract third-parties to design, then attend site to implement and test design modifications, whilst manageable, are not considered by Delta Electricity to be associated with relatively minor costs. Modifications will most probably require separate Unit outages on each Unit to implement and then require a more significant testing period. Typical design changes on installed Units often incurs testing costs in the order of $500k. Put more simply, if third parties are required to redesign an existing controller, Delta Electricity would view the associated costs, inclusive of Unit outages and subsequent testing, as significant. AEMC reconsideration of this point would be welcomed by Delta Electricity.

Considering the Rule will only exist for three years, Delta Electricity suggests more latitude around partial exemptions to PFRR parameters is required to encourage AEMO and participants to reach more flexible compromises on existing controllers with deadbands that can easily adjusted on in-service machines. If such controllers can’t easily meet other aspects of the PFRR without redesign and require outages for implementation, the in-service adjustment and existing capability should be favoured. Also take note of point 3 below.

It might be worthwhile separating the criteria to be applied to participants with existing frequency controllers that can be adjusted on an in-service machine from that to be applied to participants, that presently have none, to design and construct new controls.

2. PFRR parameters other than deadband applied existing controllers

Existing controllers have been designed and constructed before the Rules and the PFRR now to be adopted. In many existing controllers, the adjustment of frequency response deadband is quick and simple to do, can be performed whilst the machine is in-service, and will generally achieve the main objective of the proposed Rules i.e. to improve PFR and address the system security concerns.

Achieving a tighter deadband on existing controllers, where adjustment is possible on an in-service machine, should be the only mandatory obligation for these machines to meet AEMOs PFRR.

3. Potential delays to implementation

The timing of PFR improvements required in the NEM is important to consider. To urgently address the system security risks considered to exist, the application of the mandatory rule should seek rapid improvements to frequency performance from existing controllers by adjusting frequency deadbands and accept other existing capability.

Rapid improvements in PFR by way of the simple adjustment of deadbands of existing controllers, where possible, should be the first implementation outcome. Modifications requiring third party design and implementation, if required to meet other parameters in AEMOs PFRR, will delay the implementation of PFR improvements considered to be already available on around 10000MW of installed capacity as previously offered in the trial proposed in 2019 by the AEC and its members.

The resources that design, install and test more substantial control modifications are often resource constrained and booked months in advance for activities at different power station sites all over the NEM. If all participants are making separate requests to use similar resources to develop and test

modified designs that meet PFRR requirements other than deadband, the NEM might only see performance improvements in three to four large Units per year.
Design modifications will probably require Unit outages to be implemented. Planned outages on larger Units are events that occur only once a year which will limit opportunity for design changes to be implemented.

Considering the Rule will only exist for three years, Delta Electricity suggests more latitude around partial exemptions to PFRR parameters (other than deadband) is required to encourage AEMO and participants to reach compromises that seek the most simple and rapid improvements to PFR outside an assigned deadband.

The draft PFRR may be relevant to be fully applied to new controllers but design and construction lead times will be similar to major design changes on existing controllers and will also contribute to potential delays in efforts to reduce the risks to system security.

4. Inconsistency in applied Deadbands on participants in any particular region

Delta Electricity considers the adoption of a deadband of +-15mHz in frequency controllers, other than in mechanical governors, has no prior experience in the Eastern Australian interconnected systems. The large Units in NSW, for example, prior to the commencement of the NEM, had frequency controller deadbands set no tighter than +-50mHz providing support to the mechanical governors which have an inherent deadband of +-15mHz.

However, the inherent deadband in the mechanical governor is quite separately mechanically detected and reacted to than the deadband in electronic FCAS controllers. It is not a correct assumption to make that the assignment of the +-15mHz to both will result in more stable and superior performance overall than current conditions. The adoption of tighter deadbands on existing FCAS (or new PFR systems) frequency controllers should be approached from the wider existing settings towards the tighter. The transition towards +-15mHz may uncover possible impacts from mismatched or oscillatory responses between one machine and another requiring the deadband to remain at a setting wider than +-15mHz.

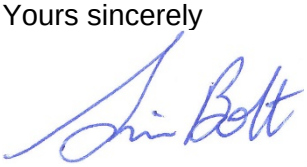
Delta Electricity confidently predicts a 50mHz deadband applied to existing FCAS controllers can be adopted because there has been prior experience with these settings on large machines in NSW. Delta Electricity is less confident that +-15mHz applied on existing FCAS controllers (or new PFR controllers) in NSW will be stable as there is no experience with these conditions to draw upon as a reference. The WA case study and experience, whilst interesting, is not necessarily evidence that the interconnected five eastern states will be adequately controlled at this deadband. There are other factors that the implementation of the Rule may soon uncover.

AEMO, presumably will develop testing and implementation strategies to determine capability of the overall NEM and, in the revision to the draft PFRR, predict in the draft clauses for partial exemption, that some Units or Station may not produce secure outcomes for the station or the local area if required to operate as tight as +-15mHz. Variations of deadband settings in a region, if they result from the AEMO process, will potentially produce unfair outcomes where one participant with similar technology and equipment to another might end being assigned a different deadband.

Delta Electricity recommends consideration in the final determination to require AEMO, in implementing the Rule by way of its PFRR, to relax the assigned deadband on all units within a particular region, to the widest deadband found necessary to be assigned to any one participant within that region. Such an outcome to Delta Electricity is considered a fairer outcome than might otherwise occur.

Delta Electricity looks forward to the final determination and its application to promptly address the system security risks associated with present frequency performance. If the AEMC wishes to discuss any aspect of this letter please contact Simon Bolt on (02) 4352 6315 or simon.bolt@de.com.au.

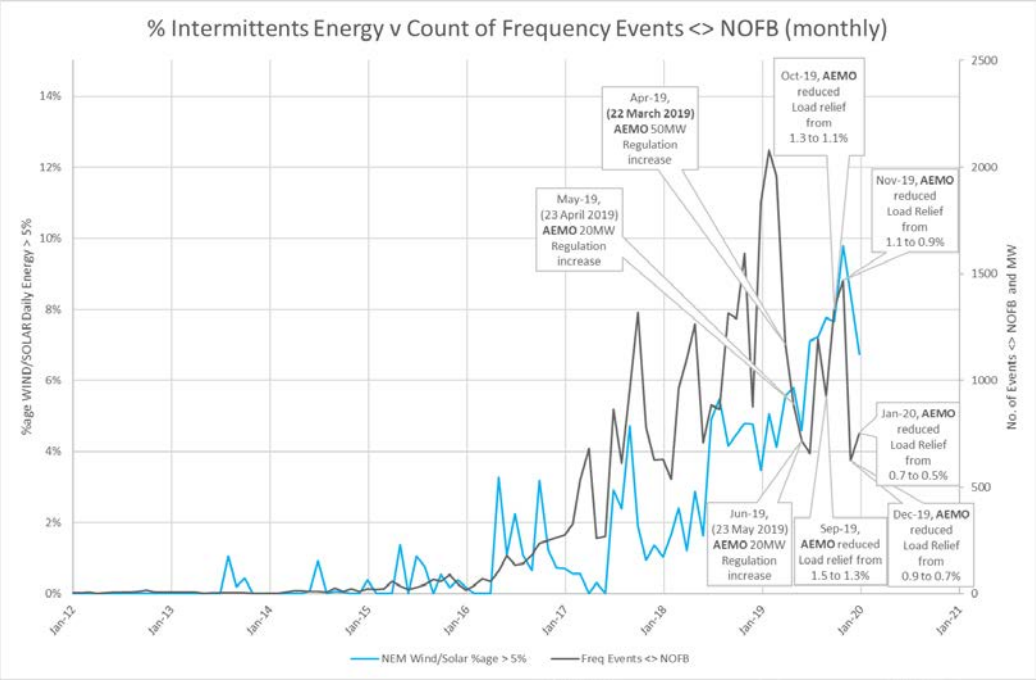
Yours sincerely



Simon Bolt
Marketing/Technical Compliance
Attachments:

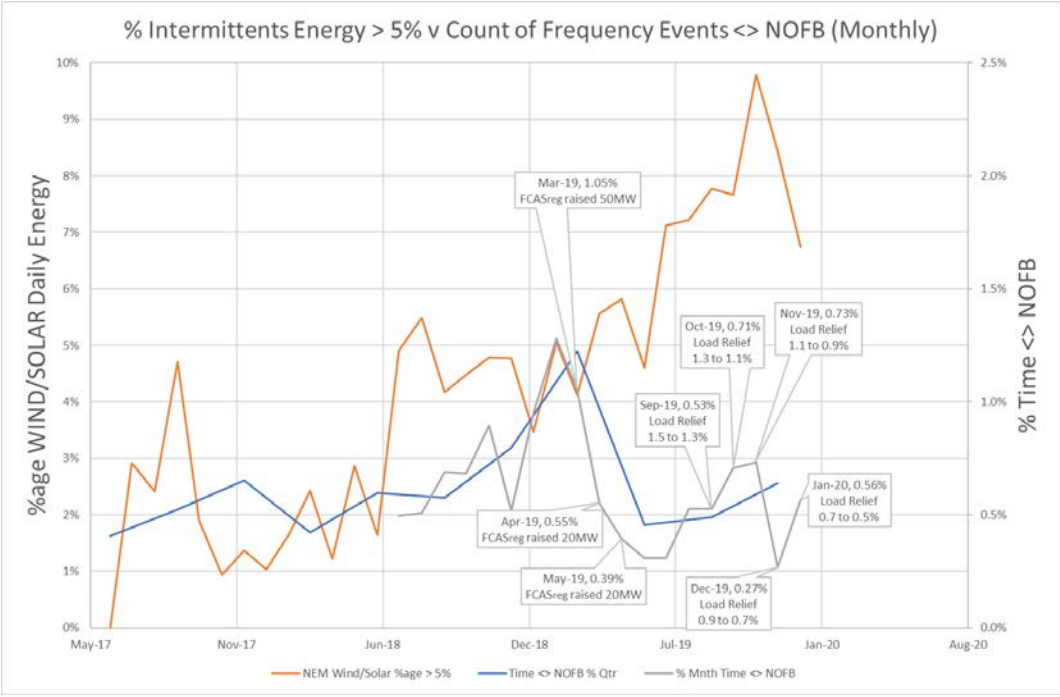
1. **Trend of Frequency Performance 2012 to now**
2. **Frequency Histograms October 2019 to January 2020**

Attachment 1 – Trend in Frequency Performance 2012 to now



Improvement in performance (as displayed in trends of counts of events occurring outside the NOFB), appears to have occurred with the increase in Regulation FCAS dispatch March to May 2019 with some suggestion of further improvement over September 2019 to January 2020 as a result of load relief percentage reduction and subsequent increases in dispatched contingency FCAS volumes.

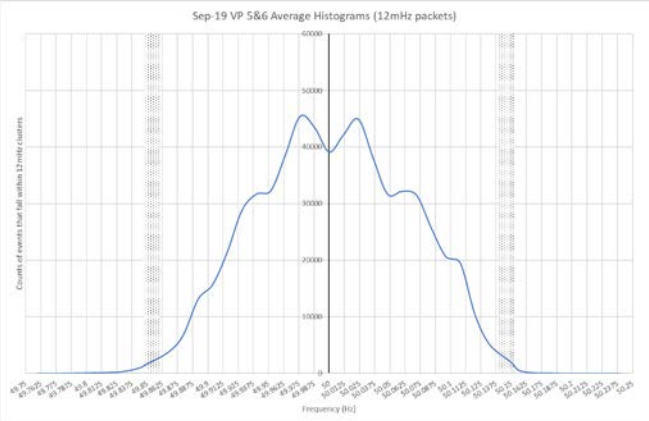
Performance, as indicated by time outside the NOFB or event counts is back to 2017 levels as a result of adjustments to FCAS dispatch by AEMO made over 2019 to early 2020.

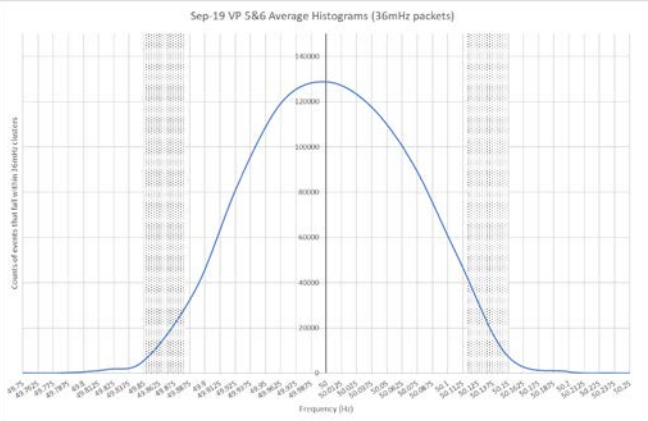


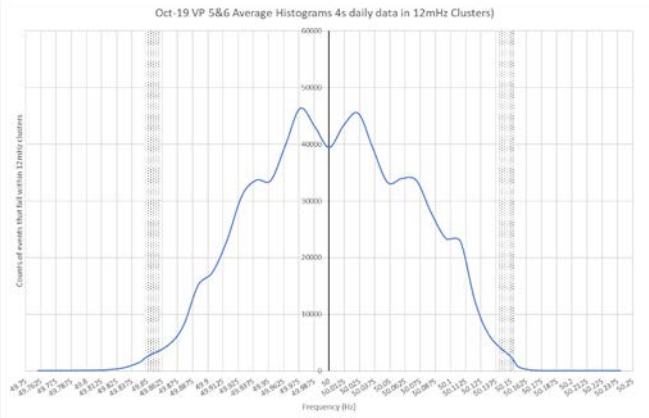
Attachment 2 – Frequency Histograms October 2019 to January 2020

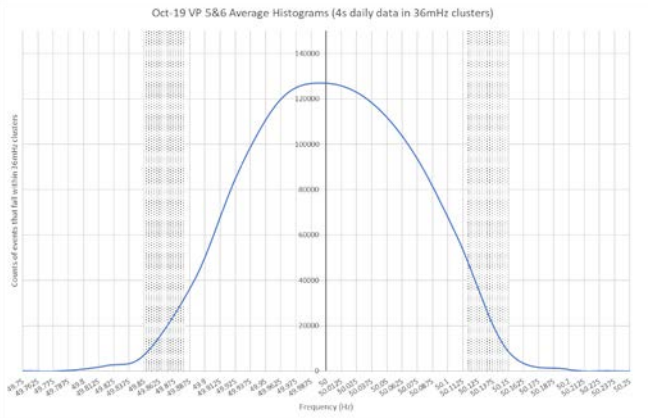
The following monthly histograms are drawn from daily files of 4second sampled data as recorded at Vales Point using frequency recorders installed on Units 5 and 6. The error in the recorded value has been confirmed by routine calibration against NATA certified injection equipment to be 0.02% which equates to +- 10mHz.

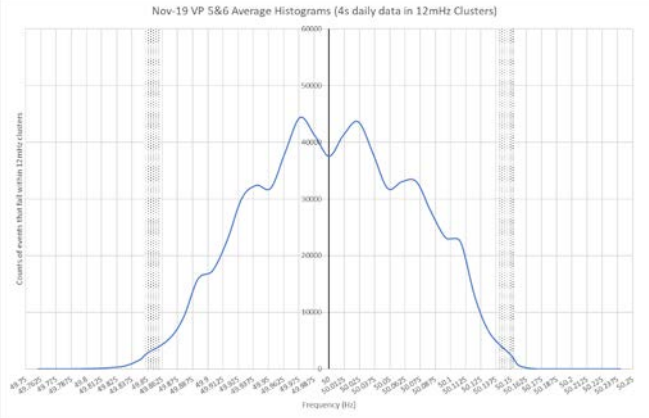
Separate histograms have been prepared from the same daily data using 12mHz and 36 mHz packet size analysis respectively. Each histogram is centred on 50Hz such that the central summated packet is representative of a count of 4s frequency data points found between a range of 50 +- 0.06mHz or 50+- 18mHz. All other packet count ranges radiate out from 50Hz in low and high frequency ranges uniformly assessed over an equivalent 12 or 36mHz deviation to produce a consistent result.

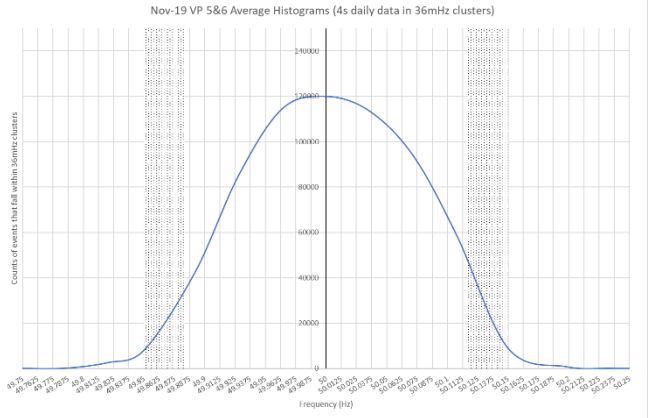


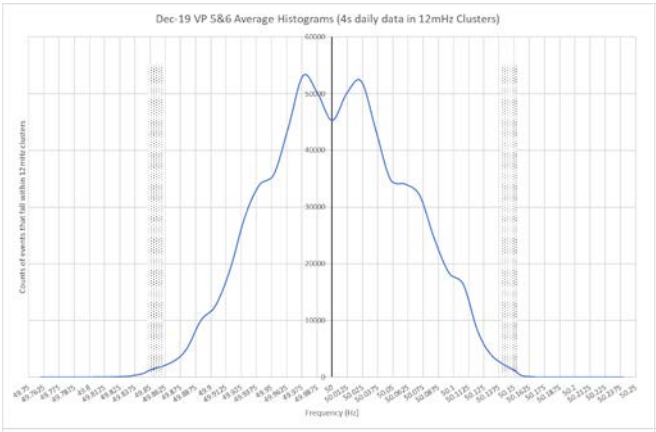


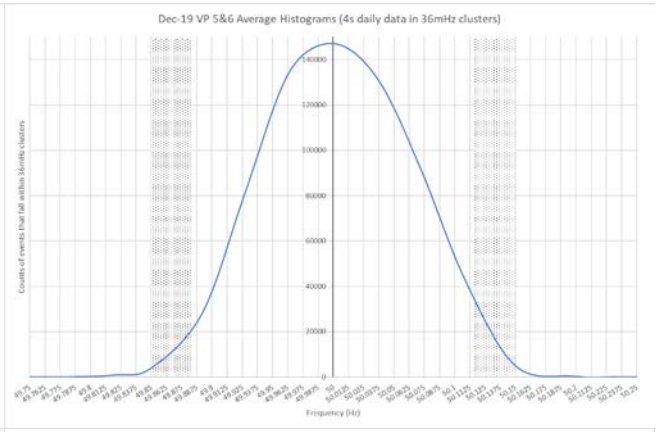


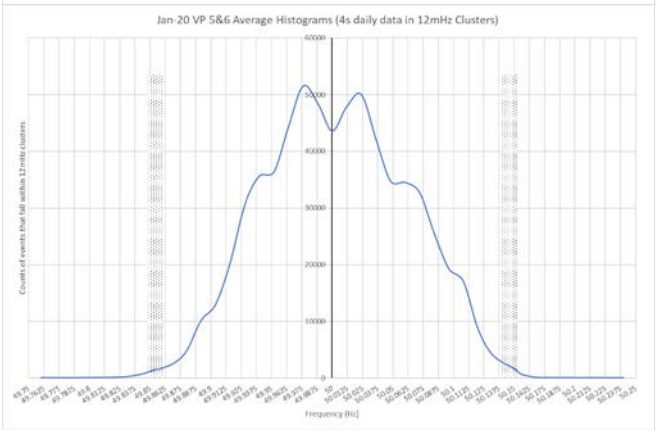


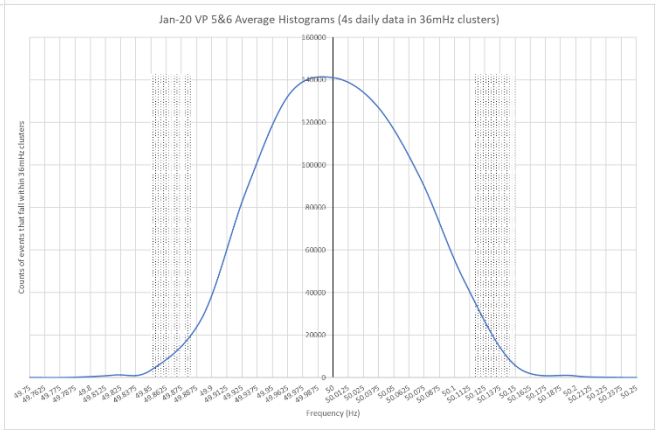


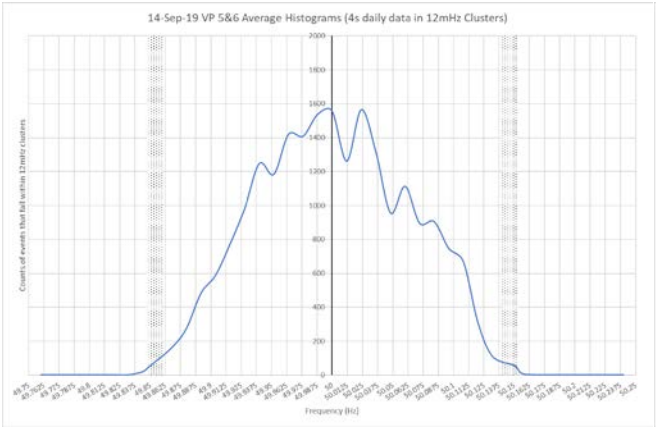


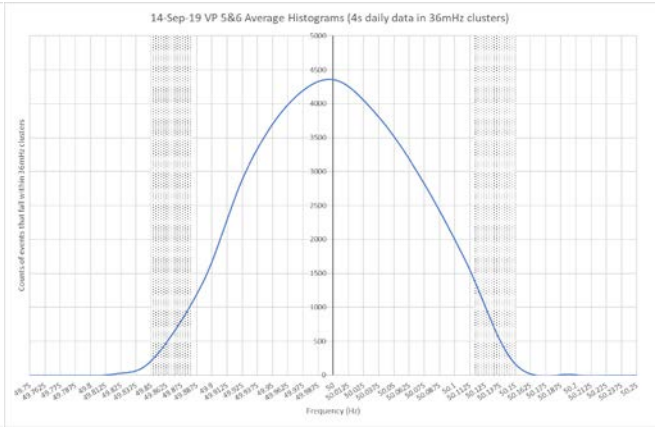












Unit 5 and 6 records show consistently similar results demonstrating confidence that the measured data, measured separately on the two Vales Point Units, is consistent. For the histograms above, the daily results from the two units are averaged to produce consistency on days when a Unit is out of service. On the 14 September 2019, a recent day when both Vales Point machines were out of service, Delta obtained an alternate source of 4s frequency data, supplied upon request to another market participant, from a recorder located at a connection point closer to the centre of the NSW system. For comparison between recording locations and recorders, histograms of that single day are also included but, as can be observed, the 12mHz packet analysis for just a single day is not too similar in shape to the monthly charts from the Vales Point recorders.

It has not been confirmed that the Vales Point histograms are truly representative of real system frequency variation, and hence indicative of the frequency erraticism that is concerning AEMO, or

instead is displaying some inherent unreliability due to the equipment used, the measurement technique, noise in the signal or the packet size being too close to the error in the signal measurement to be sensible.

The histograms assessing 12mHz packet counts appear consistent in shape month to month suggesting frequency variations are occurring in a consistent way as far as Vales Point recordings are concerned but as mentioned above could be indicative of more local conditions or recording signal inadequacy. Unfortunately, without NEM records of similar detail being published routinely, it is not possible for Delta to determine.

However, if the data and histograms are found to be reliable and repeatable elsewhere in the NEM, a possible standard for quality for the NEM could be developed that defines consistency in the distribution. For example, if the 12mHz data is truly representative of existing conditions and the variability that is occurring in frequency as sampled at the 4s rate, the standard could describe a more smoother outcome expected in the resultant histogram and the future market solution could then seek to deliver PFR services that strives to have the market meet the defined standard.