MASS Consultation – 1-1 meeting minute summary

AEMO held 1-1 stakeholder meetings following the conclusion of the first stage of consultation on the amendments to the Market Ancillary Service Specification.

These meetings were held to seek further clarification on information provided by stakeholders in submissions, or at the formal request of stakeholders seeking to discuss or provide additional information. A summary of the minutes from each meeting has been provided below.

Note:
Bold comments represent AEMO

Non-bold comments represent Reposit

1. Reposit

1.1 Agenda

The meeting was held at Reposit's request to discuss the questions below, AEMO is publishing the detailed minutes at Reposit's specific request:

1) Regarding energy summation error assumptions:
   Reposit has established the concept of an "energy summation error" to explain how measurements with a lower capture rate could result in a 'high energy sum error' and a 'low energy FCAS response'. AEMO believes that it is a useful concept for examining the matter of measurement requirements and would like to understand the assumptions made by Reposit.
   a) The MASS specifies an error of less than or equal to 2% for the measurements of power flow and not energy. If energy was used to verify FCAS compliance, an FCAS provider could then delay the start of the FCAS response and have a larger step change in active power after a few seconds of the Frequency Disturbance Time (FDT). Using energy as a compliance measure would not be sufficient as a 2% error for the measurements of energy instead of power could result in an under-delivery when the frequency disturbance starts, and an over-delivery a few seconds after the FDT. Can Reposit clarify why is the error when using data at a lower capture rate not measured over each sampling interval rather than being accumulated over 6 seconds?
   b) In Reposit's calculation of a total energy 'error', the assumption appears to be that all devices are oscillating in a similar manner to the problematic device highlighted, resulting in a 'low energy FCAS response' across the fleet. Is this correct?
   c) Is it Reposit's view that the 'energy sum error' would increase across the fleet and reach the maximum error at 6 seconds from the FDT, and remain unidentifiable due to data being captured at a lower rate?
2) Regarding AS/NZS 4777.2:2020 inverter specifications, does Reposit consider that the DER sampling rate specified in the MASS should at least meet the measurement time specified under Table 2.5 of the AS/NZS 4777.2:2020 and if so why?
3) Regarding the calculations of the assumed energy delivered:
   a) AEMO is keen to understand the impact an alternative high-speed measure, such as a 100 ms resolution, would have on Reposit's calculation of the % error based on the 3 identified (non-polynomial) options.
   b) As the measurements of power and frequency must be captured on a common time scale, why does Reposit regard the trapezoidal method as more accurate than the left Riemann method?

c) If data was to be captured at 100ms intervals, which seems to give an error of ~1.67% (using the same methodology applied by Reposit), does Reposit consider the 100ms data capture rate to be reasonable? Do concerns with potential oscillations within 100ms intervals still exist?

4) Regarding the location of FCAS measurement and estimated error for device/asset level measurements:
   a) Can Reposit elaborate how the fleet operational data has been used to estimate an error of 6% with device-level metering?
   b) Does Reposit think that the measurements at the asset level should be captured if there is more than one market participant behind the meter or should measurements of power from, or to, the grid be sufficient to verify FCAS compliance?
   c) If there is one FCAS provider for an EV and another for the controllable loads such as a hot water system, what is Reposit's view if the FCAS verification is completed using the grid flow but the data from the asset/device level is also captured in case there is an under-delivery and AEMO needs to confirm the asset that under-delivered?
5) Can you explain further why Reposit considers that an error in FCAS contingency response will result in AEMO purchasing additional Fast FCAS?
6) Can you explain this statement and how you arrive at this conclusion - "Reposit is unconvinced that device-level verification is consistent with the NER as it stands."
7) Does Reposit consider that the current contingency FCAS capacity of VPP Demonstration participants (less than 30MW) will reduce AEMO's ability to manage the power system? If yes, what evidence does Reposit have to support its view?

2. Items for discussion or Noting

2.1 Question 1 (a)

Regarding energy summation error assumptions:

Reposit has established the concept of an "energy summation error" to explain how measurements with a lower capture rate could result in a 'high energy sum error' and a 'low energy FCAS response'. AEMO believes that it is a useful concept for examining the matter of measurement requirements and would like to understand the assumptions made by Reposit.

a. The MASS specifies an error of less than or equal to 2% for the measurements of power flow and not energy. If energy was used to verify FCAS compliance, an FCAS provider could then delay the start of the FCAS response and have a larger step change in active power after a few seconds of the Frequency Disturbance Time (FDT). Using energy as a compliance measure would not be sufficient as a 2% error for the measurements of energy instead of power could result in an under-delivery when the frequency disturbance starts, and an over-delivery a few seconds after the FDT. Can Reposit clarify why is the error when using data at a lower capture rate not measured over each sampling interval rather than being accumulated over 6 seconds?

2.1.1 Reposit's response

- Reposit is not indicating that energy should be used as a verification mechanism; the MASS verification mechanism of using power is appropriate because time is important in Frequency control.
  - Reposit indicated that responses must start on time, and for the specified duration.

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- Reposit indicated there is a need to discuss what FCAS means, understand energy from Reposit's perspective and how it is calculated.
  - Consider these components of the MASS document:
    - Section 3.3 – Describes how the MASS determines what delivery means and states the time average of power across the interval being used (6s, 60s etc.)
    - Page 7 defines time average – integral or the power measurements.
  - Reposit note that each market is set up at different intervals, so if there is 1 generating unit with specific nameplate power rating, if you measure in power you can identify across each market that the number being measured is the same across each market. If energy was to be used, it would not be the same because it would change dependent on the length of the interval.
- By using time average, it is considered a proxy for energy. When looking at a specific interval and the time average of interval, it corresponds to a given energy, however these numbers are easily compared across different interval lengths.
- FCAS is an energy service measured with power because it (fast services) is there to arrest a frequency deviation. The frequency deviation is caused by a lack/excess of 'work' (energy). The market is defined in terms of 'power' which is a convention – it is not power that matters, but the work.
- **AEMO considers that the work done from the start of a disturbance is what matters. Does Reposit consider that the total energy delivered in the first 6s is more important?**
- No, and note that is why the market uses power. Not because work isn't important, but because we need to look at work done at a specific time. We could use energy focusing on the number of kilojoules provided in the first 6 seconds and that X number of mega joules delivered over the first 60s. However, using the 'power' convention, it implies time in the formulation of the markets.
- The MASS does not specify what the power trajectory looks like, just that in the first 6 seconds you must deliver a certain amount of energy, measured by looking at the average power across the time.
- **Is the 16-17% error (*indicated by Reposit*) the maximum error recorded at 6s? Is it assumed that the error will keep accumulating between 0-6s and will be at the 16-17% error at the 6s mark.**
- Reposit noted that this is not exactly the case. To find the time average as per the MASS definition, the time average is an integral. There is a sequence of meter readings and we have to integrate a continuous function across 6s, and there are samples of that function so the integral of that function needs to be found from those samples. The 16% error comes from the way the samples are integrated. The continuous function is not available so there is a need to approximate the integral using the samples. Therefore, there is no notion of the error accumulating over time because the error is being incurred as the time axis is being removed.
- **AEMO sought to confirm if the error measured at 1-2s, or at 4-5s of the event is still 16%-17% and doesn't change. For example, is there a 17% error at each sampling point?**
- The error is not seen on the sampling point, it is seen on the final time average. By integrating, we remove the time component, so cannot look at this at a specific time.
- **AEMO noted that they understand this point.**
- Reposit noted that it is not clear from AEMO what calculation method is being used – this error is based on the best case scenario (trapezoidal calculation), but gets worse when using other methods.
- **AEMO confirmed that a time average is used – measurements, averaged and divided by 2.**

- Reposit notes that they consider this an integral (***AEMO agreed that it is an integral over time and acknowledged that it is important to know the exact timing of frequency disturbance and how it is characterised***). Reposit also noted that error is important to consider but that currently this isn't defined and the system works. Trying to introduce change to this without knowing current error; Reposit is attempting to understand precisely the current situation and what this will be after changes in measurement accuracy, and sampling intervals as these will increase the error. This results in 2 choices – buy more FCAS or increase likelihood with UFLS (which will never be done by AEMO due to customer reliability). Reposit will look at the Verification Tool (VT) with regards to the calculation. AEMO stated that ultimately the source of truth is AEMO's assessment and the FCAS VT supports this.

2.2 Question 1(b)

b. In Reposit's calculation of a total energy 'error', the assumption appears to be that all devices are oscillating in a similar manner to the problematic device highlighted, resulting in a 'low energy FCAS response' across the fleet. Is this correct?

2.2.1 Reposit's Response

- Reposit notes that this does not matter as the result from oscillations is not gaussian and therefore cannot be understood or used as a determinant of how much risk can be taken. Also noting that even if the error within the error bounds is known, how would AEMO decide how much risk to take (One standard deviation of risk, 2 standard deviations?). Fundamentally, AEMO is focussed on error bounds and does not want to go inside of these error bounds as this results in increased risk of UFLS. Need to characterise your probability density function for error then decide on how much error AEMO is comfortable with or decision is made to stay away from the error.
- **AEMO sought to confirm if one device is oscillating, it does not mean the other devices are doing the same thing at the same time because it depends on where the measurements of the oscillations commences and therefore will be different across the fleet?**
- Reposit also noted that not all devices oscillate and AEMO does not know what the oscillations look like, which device is oscillating, not oscillating, where the measurement started or when the oscillations started in the case where they are oscillating. This information is unknown. What is known is that AEMO does not want to operate inside error bounds, and if operating outside of the error bounds, what is occurring inside the bounds is not impacting AEMO.

2.2.2 Question 1(c)

c. Is it Reposit's view that the 'energy sum error' would increase across the fleet and reach the maximum error at 6 seconds from the FDT, and remain unidentifiable due to data being captured at a lower rate?

2.2.3 Reposit's Response

- Reposit not that the error bound is based on known inequalities about the integral so are not dependent on what is being integrated. The error bounds apply where you have taken a number of measurements, and you get some value from the approximate total of those measurements. It is known from the inequalities that the real total of those measurement is somewhere between the error boundaries
- **AEMO requested to clarify if it is the case that the higher the resolution, the higher the likelihood of identifying what the error is?**
- Reposit indicated that there is no idea what error amount exists currently, it is just known that it is somewhere between the error bounds. As we increase the number of samples being used or the frequency of the readings, the error bound

becomes smaller so the approximation is improved. This is completely independent of what is occurring, but that more information is available and therefore less assumptions are being made making the error bounds smaller.

2.3 Question 2

Regarding AS/NZS 4777.2:2020 inverter specifications:

Does Reposit consider that the DER sampling rate specified in the MASS should at least meet the measurement time specified under Table 2.5 of the AS/NZS 4777.2:2020 and if so why?

2.3.1 Reposit's Response

- Reposit does not see AS/NZS 4777.2:2020 as relevant for this. The 2 specifications are used for completely different things – AS/NZS 4777 measures electrical quantities "to ensure the stable and reliable operation of the inverter protective functions and all modes of operation". The MASS measures electrical quantities to manage frequency recovery after an under or over frequency event to arrest frequency fall or raise, and recover the frequency as required by the FOS. While they are both measurements, these are completely different purposes. AS/NZS 4777 attempts to do no harm. Fast FCAS is trying to rapidly improve the immediate system security outlook.
- **AEMO confirmed that they understood the key point to be that they serve different purposes. However, noted that the question was more focused on the fact that 100ms was deemed to be appropriate within the Australian standard, and although it does not serve the same purpose, sought to understand if Reposit felt it should be aligned?**
- Reposit noted that this is irrelevant and does not impact the MASS. They indicated there is no specific reason these need to be aligned.
- The question should focus on fit for purpose against the defined outcomes. Reposit is indicating that the outcomes are very different, and the measurement needs to meet the requirements of the outcome.
- **AEMO questioned what Reposit's view is on the MASS being aligned with the 100ms measurement time specified in the Australian standard?**
- Noting in the Australian standard the measurement of power is 200ms ***(AEMO stated that it is 100ms for frequency, Reposit later clarified that Frequency is important for time alignment and triggering but it is not important for the calculation of work***) and power is what counts as this gives information on the energy delivered against the frequency deviation and it is work that is important, so the measurement error AEMO is concerned with is on power, not frequency. The error at 200ms will be between 7-10% depending on how the 2 different errors within the data is handled.
- **Putting aside the Standard and focusing on the 100ms, what is Reposit's view on the measurement time at 100ms?**
- If error does not change, then Reposit does not see an argument for increased FCAS costs or decreased FCAS efficacy/effectiveness. As soon as error is changed, we need to consider how much compensation is needed to accommodate this error. At 100ms, there is increased error (approx. 2-3.5% increase depending on how the error propagation is calculated for non-gaussian measurement). AEMO needs to decide if the error is increased, how it will be compensated and the cost of this, then work out if this is efficient – are the savings from slowing down the measurements greater than the cost of increasing the error in Fast FCAS? It is not a case of if this is reasonable or if it is a good idea; it is about efficiency.

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2.4 Question 3 (a)

Regarding the calculations of the assumed energy delivered:

a. AEMO is keen to understand the impact an alternative high-speed measure, such as a 100 ms resolution, would have on Reposit's calculation of the % error based on the 3 identified (non-polynomial) options.

2.4.1 Reposit's response

- Reposit noted an action to calculate the 3 methods, however stated that they know the trapezoidal error has the lowest error of the three options, and this is why Reposit assume this was used.
- Reposit later forwarded an email to AEMO with their calculation of the error associated with sampling rates of 1s, 100ms and 50ms as summarised in the table below:

Integration Computation	Interpolation Error @ 1Hz	Total Max Error @ 1Hz	Interpolation Error @ 10Hz	Total Max Error @ 10Hz	Interpolation Error @ 20Hz	Total Max Error @ 20Hz
Left Riemann	33.33%	35.33%	3.33%	5.33%	1.67%	3.67%
Right Riemann	33.33%	35.33%	3.33%	5.33%	1.67%	3.67%
Trapezoidal	16.67%	18.67%	1.67%	3.67%	0.83%	2.83%
Sampling rate (Hz)	*1*	*1*	*10*	*10*	*20*	*20*
Notes:						
Assumes a integration period of 6 seconds						
Assumes a measurement error of 2% of the measurement range						
Assumes that measurement error is Gaussian (due to physical processes in electrical quantity measurement)						

- Reposit noted in the same email that the measurement error (2% of the range as per the MASS) is Gaussian as it is most likely due to physical processes (electronic noise). But the interpolation error is not Gaussian as it is not based on a physical process but on the control mechanisms of the battery. If they were both Gaussian we could use a quadrature to sum them, but because they are not, we need to do a linear sum.

2.5 Question 3(b)

b. As the measurements of power and frequency must be captured on a common time scale, why does Reposit regard the trapezoidal method as more accurate than the left Riemann method?

2.5.1 Reposit's Response

- These exist in a sequence of increasingly accurate approximations and the trapezoidal rule is the next one after the Reimann calculations (in literature). It has some extra benefits such that the options further along the sequence are less accurate in this specific circumstance. There is mathematical literature that proves this.

2.6 Question 3(c)

c. If data was to be captured at 100ms intervals, which seems to give an error of ~1.67% (using the same methodology applied by Reposit), does Reposit consider the 100ms data capture rate to be reasonable? Do concerns with potential oscillations within 100ms intervals still exist?

2.6.1 Reposit's Response

- The VT should be changed to be the same as whatever method AEMO use. Reposit is not aware of what AEMO currently use, but are attempting to reverse engineer from the interpolation of the 2% error measurement and the sample rate at 20Hz to determine what the existing error is so that we can understand what it is at the moment and what impact the changes may have. ***AEMO agrees that reverse engineering the VT is worthwhile in understanding the associated measurement error***.
- **AEMO provides an excel spreadsheet laying out the calculations on their website which can be referenced.**
- Reposit notes that there is a significant amount of hidden cells/assumptions within the VT
- **AEMO takes on board this feedback and will review the VT. One of the issues Reposit may have with trying to characterise the existing VT tool is the time aligning correctly.**
- Reposit notes the importance of correct time alignment and highlighted the variations that occur when time alignment is even slightly different and the impact this has on outcomes. Reposit pointed out that you have to assume that the power curve is unknown and only the error bounds can be calculated.
- Reposit notes that this forum is not to facilitate questions, however, if provided the opportunity to ask a question would ask: Does AEMO care as to what the error is now or is the focus on what the error will be, because currently the error is not an issue? With the assumption that as error increases, AEMO will need to compensate for that error.
  - **AEMO indicated it is also important to note that this is only the error in the measurement. The whole component of FCAS specification delivery has layers of error on top of each other. It is important to determine how significant this error is on top of all the other errors.**
  - Reposit sought to clarify what the other errors are?
  - **AEMO noted that these include error in the decision on how much FCAS is needed to cover the event, when load responses are characterised, whether a single 'one-size-fits-all' approach is appropriate or if this is 'sculpted' and the data used to determine this, and when units respond etc. Measuring FCAS is just one error.**
  - Reposit noted, to that point, it is an uncharacterised error environment, but it currently works. Danger exists when this environment is adjusted, and it is unclear what the outcome will be.
  - **AEMO also noted that the FCAS VT is not the only method used in assessing FCAS performance. It is used as a screening tool. After major disturbances, further investigation is done on the response. Registration detail is also considered.**
  - This may be the case, but the VT is also a guide for implementing FCAS. There is also implicit and unpublished service definition but Participants are not aware of this – only the MASS and VT is available.
- Reposit consider that actual objective of FCAS from a system security perspective and how this is achieved noting that the key component is 'work'.
- If metering is slowed down, less data is available to determine why things went up/down and who contributed to it etc. which Reposit consider is not ideal for AEMO.

2.7 Question 4 (a)

Regarding location of FCAS measurement, it appeared Reposit has a number of points to raise…

a. Regarding the location of FCAS measurement and estimated error for device/asset level measurements:

Can Reposit elaborate how the fleet operational data has been used to estimate an error of 6% with device-level metering?

2.7.1 Reposit's Reponse

- This area is complicated and statistical – Reposit has a process that runs after every trip that looks at what Reposit's instantaneously calculated availability is at the AC terminals of the inverters. Reposit then looks at what was actually delivered. The delta between these 2 figures is then compared for a particular trip in aggregate. This is done as there is an availability discount factor that is moved around to ensure bids (offers) are conservative. Reposit is then able to determine what the availability discount factor is.
  - Reposit is able to determine which components of the discount are related to the trip time (i.e. what part of the discounting is related to being too slow). Remainder is attributed to the effect of behind the meter loads because we have taken out everything that is time variant, so we are now left with the time invariant. And that is now an independent variable that has to be behind-the-meter loads.
- **AEMO questions if the MASS FCAS VT was using measurement at the device level rather than the measurement at grid flow, would that show a 6% difference?**
- Reposit indicated that the same resolution data is not available, so comparison is not accurate.
- **If the 5s data currently available to Reposit at device level is used, and this is compared to the 1s data available at the grid point at 5s intervals, would you then see a 6% difference?**
- Reposit responded 'No' indicating this incurs different errors (noise etc.) and is not comparable. Reposit does not record the data at 5s – it is used to drive an App/machine learning. It is not used for measurement for verification.
- **AEMO understand this but is it possible for Reposit to look at the data and confirm what the error actually is.**
- Reposit does have this information and it is in a time series database, but the difference in sampling is just too great (20Hz vs 1/5th Hz data). Reposit indicated they could do it for 1-2 devices but don't see this as necessary as a calculation is available to provide the information. Reposit only has information available from the inverter, so anything else is considered load.
- **AEMO is still unclear as to how Reposit obtained 6% error.**
- Reposit calculates at a point in time for a particular trip what the inverter can put out, and expect a certain amount of energy from the connection point. Reposit then (at aggregate) looks at what actually went out the connection point. Then looks at the difference between the two sets of information, we note X% is lost. Of that X%, part is behind the meter load response, whether or not the control was busy at the time and so missed the frequency start by a portion of time, and whether or not the inverters are 'happy' with us (i.e. some inverters are faster, some are slower). When the time variant component is removed, we are left with an approx. error of 6% - sometimes it is more, other times less. Reposit later added that a statistical analysis could be done to determine the value and its variance. Reposit considered that AEMO should also be able to do this analysis from the VPP Demonstrations data, and the results could be compared and should be the same.
- In the Knowledge Sharing Reports (VPP Demo) it indicates that under-delivery was detected due to behind the meter loads so it is clearly something that is degrading FCAS.
- **AEMO sought to clarify – Reposit's submission indicates 6% as estimated error in the device vs connection point, including all behind the meter devices and solar.**

- It does not include solar as Reposit's fleet is mostly hybrids so is aware of what the solar is doing. We have to bid less when it is sunny to accommodate because we can see this – availability is reported on 5min basis.
- **What are the 5-second reports that Reposit receive?**
- Reposit gets a report on a 5-minute basis on what we can bid in for the upcoming 5-minute period, which is based on the 5-second data received from the devices. This report also provides the general operating state of all the systems (e.g. Battery self-consumption)

2.8 Question 4 (b& c)

b. Does Reposit think that the measurements at the asset level should be captured if there is more than one market participant behind the meter or should measurements of power from, or to, the grid be sufficient to verify FCAS compliance?

c. If there is one FCAS provider for an EV and another for the controllable loads such as a hot water system, what is Reposit's view if the FCAS verification is completed using the grid flow but the data from the asset/device level is also captured in case there is an under-delivery and AEMO needs to confirm the asset that under-delivered?

2.8.1 Reposit's Response

- Reposit doesn't think about it that way because there is no answer. The energy that makes it to the connection point is all that AEMO is concerned about.
- **AEMO noted that it is important if there is an under-delivery and need for clawback and compliance.**
- Everything should be clawed back because if AEMO thinks that a certain amount of energy should be provided by a site but this is not provided, and only one of the devices did a good job at delivering but the other devices did not, or took this in, it does not assist AEMO with meeting the energy requirements for the deviation.
- **AEMO is considering in this instance how the devices are working together (assumption is that they are) but one device is enabled for 1kW and the other for 2kW, and at the connection point you can see 2.5kW, how do you identify who under-delivered?**
- Reposit states that this is not a real problem until it becomes one. NMIs are connection points. Measurements happen at NMIs – that is what the MASS says. If this was changed to device level metering in the MASS, this would conflict with the NER. The NER states that the connection point is where the relationship between the NEM and consumer begins. If there is device level measurement, everything breaks (i.e. is not workable). Two-sided market stream address this and are looking to redefine what connection point means – kind of like MTR. This is not limited to FCAS but applies to all markets. MTR was ruled out in 2018 – it is actively being worked on by ESB. In future, Reposit sees that having 2 parties behind the meter would result in 2 connection points (NMIs) and measurement of response would remain at the connection point.

2.9 Question 5

Can you explain further why Reposit considers that an error in FCAS contingency response will result in AEMO purchasing additional Fast FCAS?

2.9.1 Reposit's Response

- Reposit believe that this has been covered.

- **AEMO sought to confirm that Reposit's position is that any additional error results in a need to purchase more FCAS?**
- Reposit confirm that that is the case – where you have error, this translates to uncertainty, and uncertainty is a quantitative measure of risk, and this risk needs to be managed.

2.10 Question 6

AEMO asked if Reposit can explain this statement and how they arrived at this conclusion - "Reposit is unconvinced that device-level verification is consistent with the NER as it stands."

2.10.1 Reposit's Response

- This is around the connection point, in chapter 10. There is a lot of information including settlement which is dependent on connection point. A lot of stuff in the NER assumes connection point is not the device, but the revenue meter. If the revenue meter was allocated per device then that is a change in the definition of the chapter 10 connection point definition that allows everything to work. If just device level measurement is used, this is just MTR without the meter and would cause many components of the NER to not work (e.g. causer pay). This is why Reposit sees this as inconsistent and believes it would cause issues.
- **AEMO note that there is a difference between the metering at the connection point and the metering at the device level is the grid scale view – SCADA level meter at the device or asset level and revenue meter at the connection point. What Reposit are talking about is more related to the DER level, particularly when talking about the ESB and two-sided market work as it all centres around this and trying to get around the multiple trading concepts. There is more for AEMO to think about and explore – if Reposit has any specific clauses, please share these.**
- Reposit noted clauses include 3.1.4(a) which is the market design principles. To be able to allow device metering for DER only violates subsections 3 and 5 of 3.1.4(a) around technology agnosticism and equal entry for new and existing participants in the market.
- **Regarding the submission, AEMO has not made any type of argument about the NEO at this point – this will be in the draft and final reports but AEMO are very interested in Reposit's views on this so these can be included in the consideration.**

2.11 Question 7

Does Reposit consider that the current contingency FCAS capacity of VPP Demonstration participants (less than 30MW) will reduce AEMO's ability to manage the power system? If yes, what evidence does Reposit have to support its view?

2.11.1 Reposit's Response

- Reposit proposes that the VPP Demo's current capacity has 16% error vs non-VPP Demo capacity which means there is only 24.9 MW of reliable capacity, not 30 MW, with most of this is in South Australia. Device level measurement adds another 6% error which brings this down to 23.4 MW. With most of this in South Australia noting that Reposit is not aware of the extent of FCAS procurement in this region and what is the largest single contingency. If it was 140 MW, 30 MW of this is approx. 5%. At a 22% error on 5% of the fleet, this results in 1.1% error which needs to be accommodated. If AEMO was to procure FCAS, 1.1% additional FCAS in South Australia at 2020 prices, this would cost an additional $616,000 per annum which over 10 years would be $6M and who pays for that? On top of this, Reposit is aware that VPP participants

are not correctly value stacking and are double dipping – this is additional error. On top of this, Reposit has started analysis on the bids in November from the VPP Demo, and has likely detected overbidding which may be attributed to there not currently being a claw back process and maybe it goes away when the claw back process is re-established, but there is a significant degradation on the certainty of a MW from the trial in that market and this will cost money and I don't know who is going to pay for that. If AEMO purchases additional FCAS, consumers will take on the cost of this via the cost associated with the causer pays applied to generators for raise.

- **The incorrect value staking by VPPs – what specifically is Reposit referring to?**
- This is noted in the knowledge sharing reports – VPPs have tried to co-optimise FCAS and energy and there is some special arrangement that Energy Locals has proposed that was accepted by AEMO, but this sometimes results in under-delivery of FCAS due to higher wholesale prices and output was ramped up to take advantage of the high wholesale price and were no longer able to ramp output for FCAS.
- **AEMO sought to clarify if this is primarily about moving around between FCAS and energy which is not being factored into FCAS delivery.**
- Reposit confirmed this is correct, and this also relates to double dipping. But there are also other issues – over bidding, increased measurement error, behind-the-meter activities, the additional costs. That 30 MW is not reliable and this does not come for free.
- **AEMO understands Reposit's points.**

Final point from Reposit – all of these activities (the MASS consultation), are driven by supposed high cost of high-speed metering but Reposit have shown through the submission that high-speed metering is not very expensive. Others have said the same. All of this works and analysis and error is for a very small amount of savings - Reposit finds this perplexing. Right now metering is cost effective and meets requirements and it has been that way for a long time.