Submission to the: Australian Energy Market Operator Draft Determination: Amendment of the Market Ancillary Service Specification - DER and general consultation

August 2021

SolarEdge is a global leading PV inverter manufacturer with over 21GW of products shipped worldwide and 1.75 million monitored installations. The company was established in 2006 and has invented an intelligent inverter solution that revolutionizes the way power is harvested and managed in a solar PV system. The SolarEdge DC optimized inverter solution maximizes power generation at individual panel level while lowering the cost of energy produced by the solar PV system. SolarEdge entered the Australian Market in 2015, the higher level of safety and performance compared to traditional string inverters has made the company extremely successful with Australian home and business owners.

From this leadership position, SolarEdge is compelled to respond to the MASS Draft as published on the 15th of June 2021. We bring with our response an experienced understanding of the requirements to design, manufacture, delivery, operate and maintain millions of DER connection points. We use this knowledge to dispel some of the potential misunderstandings provided by previous responses in consultation processes and reality to the discussion around costs.

Critical components of the review process such as perceived power system security concerns were introduced late in the review process as a barrier to amendment of the MASS. We note that the CEC has also been working closely with AEMO to address the power system security concerns cited in the draft determination and that AEMO has articulated an intention to consult with industry outside of this consultation on the need for further studies of DER inverter behavior and as such SolarEdge are very willing to offer continued support to AEMO in this area of its work.

We also welcome the in-principal proposal to establish a Consultative Forum via the CEC with AEMO as a vehicle for collaboration between AEMO and interested stakeholders.

Internationally VPP's have been operating in wholesale markets and other services for some years. Frequency support services are currently being provided effectively in live markets and for Australia, without a pragmatic approach, AEMO's stated target of supporting 100% renewable integration by 2025 is at risk. The transition to call upon DER for energy generation, storage, control and enjoyment is accelerating as the electrification of services in homes and businesses continues. The last five years have seen a rise in the sophistication of DER and many trials developed that look to realize the full potential of DER in the aggregated assets.

The VPP Demonstrations Trial, and associated knowledge sharing reports, clearly demonstrate that VPPs are technically capable of providing fast FCAS market services and that aggregators appropriately bid in these markets.

By not adopting any of the changes tested during the VPP Demonstrations trial, SolarEdge believe AEMO is creating market risks for the future of VPP operations in Australia due to implementation of untested methodology.

A primary concern raised in the MASS Draft Determination is whether VPP performance can be accurately verified by a 1s resolution. There are a number of ways that this can already be addressed without opting to maintain the MASS in its current form. The MASS verification techniques have no impact on system operation and provide no insights to AEMO operations of VPP operations.

A further concern is that AEMO does not outwardly appear to be in line with obligations under the NEO. Primarily, if AEMO has the ability to remove costs to achieve the same technical outcome – as is the case with considering less granular measurement resolution options, then they are obligated to do so.

Our concern is that if FCAS participation barriers are too high as compared to the available pool of value, the non-participation of DER, particularly as aggregated assets working in concert, has the potential to create system issues due to lack of visibility and effective control.

An effective, accessible and inclusive market is required to enable a transition to an integrated energy market where system security and commercially responsible outcomes are delivered

We would be happy to discuss these issues in further detail with representatives of AEMO. We look forward to contributing further to this important area for policy development. In this submission we outline our concerns about the approach proposed in AEMO's Draft Determination and suggest alternatives.

1. Other Frequency market approaches

SolarEdge participates in frequency markets internationally. We are yet to come across market participation requirements for ongoing operational sampling rates at less than 1s. Australia's market is not that different to other regions that it should differ so greatly for inclusion of DER.

1.1 UK

The National Grid is the UK's Grid operator as such they impose a pre-qualification assessment process for all frequency response market participants. The testing procedure includes 2 predefined tests (pre-set frequency pattern) and an additional test against natural grid behavior (live test). For test 1&2, any provider must collect Time, Power & Frequency at maximum sample rate of 100ms and at a1 second rate for test 3. Data collected is then provided to an Independent Technical Expert (ITE) to review and approve the validity of the results and later on to National Grid for final approval.

Real time event metering requirement is at a 1 second sample rate. This data alone is used by National Grid to confirm the response quality.

As demonstrated above, National Grid has built a detailed qualification process to test and confirm the ability of a device to accurately respond to a frequency event. While the testing requirements are not easy to meet by the

typical DER due to a metering requirement of 100ms, this can be managed by many participants as required only for the testing process. Real time response is open to any device that have met the pre-qualification criteria and is able to collect and submit 1 second data, which is reasonably achievable by many type of generators.

Table 9 - Limits of error and minimum sample rates for Dynamic Service Testing

	Limit of error/ Accuracy threshold	Minimum Sample rate Test 1	Minimum Sample rate Tests 2 and 3
Frequency (Hz)	±0.01 Hz	10Hz	1Hz
Active Power (MW)	Please see pass criteria	10Hz	1Hz

Source: National Grid, Firm Frequency Response Balancing Service, Test Guidance for Providers
https://www.nationalgrideso.com/document/148721/download

1.2 USA

A pertinent example of FCAS requirements in the USA would come from our experience negotiating with the Hawaiian Electric FFR service and the metering requirements for the service, as described in Exhibit E to their Grid Services Purchase Agreement[1].

For this service, which is step Fast Frequency Response service, the metering requirement is set to 5 minutes interval. HECO cleverly focus on the response time (rather than on the measurement interval) as a way to assure the timely frequency support, and simply require from vendors to demonstrate through a mutually agreeable certification process, that the end devices are capable of detecting the frequency excursion and respond to it within the a predefined number of grid cycles (which is less than the FCAS 1 second requirement), as described in section 5.1 of page 242 of that document).

HECO also procure a (bi-directional) proportional (rather than step) frequency response service, which is even more similar to FCAS, with the same metering requirements as the ones described above for FFR, however, at the time of this submission we couldn't find publicly available information which can be referenced).

From our experience in developing this capability and actively delivering the service in Hawaii, supporting such a requirement is achievable within the existing HW and meet the utility's needs.

Another example is the signal-driven Regulation procured by the PJM (District of Columbia RTO[2];), which has been procured by PJM for years now. For dynamic resources such as energy storage devices, the system operator is using a calculated regulation signal (regD). In this case the resource is required to report on the level of provided regulation every 2 seconds (see page 40).

[1] See Page 241
https://www.hawaiianelectric.com/documents/clean_energy_hawaii/selling_power_to_the_utility/competitive_bidding/20190401_phase_2_draft_rfp_book_3.pdf

[2] see page 37 https://www.pjm.com/~/media/documents/manuals/m12.ashx

2. Australian DER VPP and FCAS Participation

As of 31 March 2021, there were over 2.77 million PV installations in Australia, with a combined capacity of over 21.4 gigawatts, the vast majority of these systems being residential DER installations. DER in Australia is therefore growing rapidly and is already recognized as a critical component of Australia's energy generation mix.

Harnessing DER energy data, as well as power utilization via VPPs embedded within the low voltage network will be vital to ensure a reliable grid with the very high levels (100% by 2025) of renewable energy penetration as predicted by AEMO, including a high proportion of generation by rooftop solar.

The Australian Energy Market Commission (AEMC) has also recently recognized the importance of VPPs and other forms of small generation aggregation in its Draft Determination on integrating energy storage systems into the National Electricity Market (NEM) and has proposed enabling small generation aggregators to provide market ancillary services from generation and loads. Delivering on the policy direction from the AEMC will require strong collaboration between AEMO, industry and distribution network service providers (DNSPs). SolarEdge is committed to working with other industry stakeholder and representatives with AEMO to make sure this is appropriately supported as it is vital for a balanced future.

As an industry participant and technical contributor to the analysis of AEMO we support the work that AEMO has undertaken in its VPP trials and other initiatives such as Project MATCH as we too support the need for enhanced DER participation in markets. Currently, however, DER policy is lacking a clear framework or agreement on which services should be provided through market mechanisms and which should be provided using regulations and standards. As a general principle, provision of system services and network services should always be paid for and should not be mandated as a condition of grid connection. This should include support for FCAS markets and voltage management on distribution networks. The only exception to reliance on market mechanisms should be genuine, well-defined emergency situations.

SolarEdge strongly supports initiatives to enable VPPs that should have full market access and participation by customers on an opt-in basis. The risk of leaving the MASS unchanged is that the additional costs involved will reduce incentives for VPP uptake resulting in a high proportion of passive DER.

SolarEdge therefore recommends maintaining the position of 1 second sampling rate for verification purposes. This is both consistent with experience from international markets and represents a least cost approach for DER to effectively participate in FCAS markets and contribute to system security.

3. Measurement & Resolution

3.1 Time resolution for measurement of FCAS delivered by DER

In the draft determination there was a view that unexpected responses from inverters might not be identified using low granularity measurement and cites the example of an oscillatory response going undetected if measurement is done at 1second intervals. However, this oscillatory response is separate to the metering and as such whether metered at 50ms, 1s or 5s the oscillation may still occur.

Furthermore, as AEMO has not divulged any data highlighting such an event it is assumed that such a situation is only a theoretical risk at this stage and as such impossible to understand the cause of or implement any prevention for.

SolarEdge has not experienced and is not aware of any actual examples of oscillatory behaviour as expressed as a concern in the draft determination.

Any oscillatory behaviour of a particular asset type should be detected during the frequency injection test that every system is required to undertake as part of the FCAS registration process. If AEMO is concerned that oscillatory behaviour is not being detected, it should review the laboratory test requirements for FCAS registration.

This concern if valid, could also be addressed with 100ms measurement intervals. The benefit of 100ms intervals over 50ms intervals would be sufficient to enable detection of oscillatory behaviour and other behaviours of concern to AEMO and the 100ms metering requirement aligns with AS/NZS 4777.2:2020.

The University of Melbourne analysis has demonstrated that 100ms resolution with large sample size provides greater accuracy than single-sample 50ms data. With an update to the MASS FCAS verification tool, it should be adopted to provide AEMO with absolute certainty of performance post the event. Again, 100ms resolution aligns with the AS4777.2:2020 metering requirement and is more fit for purpose for DER than the 50ms resolution in the MASS which was first introduced when the MASS was first drafted.

Ideally for fast FCAS measurement a resolution of 100ms should be considered viable as an alternative to the 50ms resolution currently required and included in the Draft Determination and as such should update the MASS FCAS verification tool to use the trapezoid measurement resolution approach.

A 100ms rate creates a negligible risk for AEMO over the proposed 50ms level as it sits well below the 2% allowable power measurement margin of error for fast FCAS currently allowed within the MASS. Furthermore, with regards to oscillations, there is no evidence that 50ms resolution provides any additional value over 100ms or 1s. Statistical analysis shows that the overall sample size of the fleet has a more significant impact on accuracy than the measurement resolution. A fleet of >200 sites (necessary to meet the 1MW bidding requirement) with a 1second measurement rate, has a lesser error rate than a single site with a more granular measurement resolution. This is an error that warrants further consideration from AEMO.

We understand the concerns that have led to AEMO's decision not to increase the measurement resolution to 1s. Nevertheless, we do not support the decision to leave the measurement resolution at 50ms. A resolution of 100ms

has been demonstrated to be sufficient and would significantly reduce VPP costs, which will benefit all consumers in the long term whether at the connection point or at the inverter terminals.

AEMO has confirmed that the maximum error introduced at 100ms measurement intervals is only 2.3%.

AS/NZS 4777.2:2020 commences 18 December 2021. It specifies measurement times of 100ms for voltage and frequency and 200ms for power. Alignment of the FCAS measurement requirements with AS/NZS 4777.2:2020 would reduce implementation costs and would benefit the long term interests of consumers. AEMO's observes that data functionality is specific to each inverter make and model, but this does not change the expectation that alignment of technical standards and market rules would reduce implementation costs.

With this in mind, SolarEdge remains in a position of recommending 1s sampling rates for fast FCAS verification measurement as it presents no barrier to effective verification and remove entry costs for DER participation.

3.2 Measurement of unexpected (oscillatory) responses using low granularity measurement

Unexpected responses from inverters have also been expressed in the draft determination by AEMO, although such a risk might not be identified using low granularity measurement and cites the example of an oscillatory response going undetected if measurement is done at 1second intervals.

Again, we understand that the inverter in question was never approved for FCAS registration, and the behaviour only mentioned by Reposit

The risk of oscillatory behaviour is not an argument for retaining the MASS in its current form. It is an argument for reviewing the laboratory test requirements for FCAS registration.

3.3 Power system security and measurement interval

It is unclear how the concerns about the response of inverters to power system disturbances would be addressed by requiring VPPs to measure at 50ms intervals.

AEMO has acknowledged that reduced granularity sampling will still identify inverter disconnection. We acknowledge that reducing the granularity of sampling would affect the accuracy of the verification of FCAS delivery, but the maximum error for 100ms measurement intervals would be only 2.3% and there are options to address that level of error. The Draft Determination states, "AEMO is committed to working with industry to address the DER inverter behaviour concerns, but cannot raise the 50ms sampling rate requirement until this work is complete". However, AEMO has failed to adequately explain why the sampling rate cannot be changed or how leaving the sampling rate unchanged will help to address power system security concerns.

The Draft Determination states, "While measurement resolution of 100/200ms and changes to the FCAS assessment methodology may present a reasonable compromise, it is anticipated that in the time required to assess and confirm whether this is the case, advances in high-speed metering will reduce this as a barrier to entry". However, the Draft

Determination provides no evidence for AEMO's understanding of current costs or expectation of imminent cost reductions in high-speed metering.

3.4 Inverter capability

SolarEdge, along with all other OEMS looking to offer compliant product into the market post 18th of December 2021 are in the process of redesigning their inverters to comply with AS/NZS 4777.2:2020. The standard requires measurement intervals of 100ms for voltage and frequency and 200ms for power. This is the sampling rate requirement. For frequency response however SolarEdge inverters operate at around a 20ms rate which is well within the metering resolution. We are not aware of any inverters that capture and store data at 50ms or 100ms intervals. Most capture and store data at a minimum of 1s intervals.

3.5 The cost of high-speed data capture and storage

No current DER in the Australian market has the ability to meter within the limits proposed under the MASS Draft Determination. To fall within the prescribed requirement all participating DER assets will have to have additional 3rd party devices fitted with their own specific data capturing, storage and transmission functions. To be clear, all DER will operate with metering as prescribed in AS/NZS 4777.2:2020.

Any DER system owner wishing to participate in a VPP under the prescribed metering rules of the draft determination will now need to have x3 metering services installed or upgraded to comply. One NMI billing grade meter at the connection point, one DER meter for export and / or load control plus used for a battery to charge once PV production is greater than the load amount, and now additionally one high speed FCAS grade data logger and metering solution.

Currently only Reposit Power have a solution, circa $599 for a data logger, plus $100 per meter (a single unit for 1Ph DER, x3 required for 3Ph DER)[3], typically the cost to the consumer will be $1,350 for a single phase inverter and around $2,000 ex GST for a 3-ph or multi-inverter installation (including the additional hardware). These costs are in addition to the other metering required and is only there as a prerequisite entry requirement for FCAS participation.

The requirements proposed by AEMO necessitate the installation of a separate high-speed meter as the data capture needs to be based on measurement at the connection point. AEMO requested industry to provide clear evidence of the additional costs of becoming compliant with the current MASS – it is worth noting that the diverse range of statements on costs (most without supporting evidence) in the first round of submissions, and subsequent

[3] Data provided by CEC, 4th August 2021

discussions have not provided a clear outcome on this. The true cost is well in excess of the purported $120 per meter[4].

3.6 Data capture resolution capabilities

AEMO also requested to industry clarity on the data capture resolution capabilities of OEM equipment to measure grid flow (at or close to the connection point), currently or with simple upgrades to current capabilities (e.g., firmware upgrades) and noting that this data capture capability is distinct from the sampling rates specified in AS/NZS 4777.2.2020.

It is extremely difficult, costly and wholly unnecessary to measure and transmit FCAS data in real time. Ultimately what will be prescribed will be an external device to extract and store the FCAS data at the end of each FCAS event. The cost of the external device will require development time and cost, rather than equipment cost. The development task could involve firmware changes in the meter and coordination between the meter and the inverter so that the inverter can store the data. This will most likely be complicated, especially if there is insufficient storage within the meter and changes to meters are required. Furthermore, such development work just for FCAS participation in Australia alone is unlikely to become a priority task for global inverter manufacturers like SolarEdge.

For any SolarEdge systems there is already a metering device that is responsible for metering. It is separate from the inverter, and usually connected via RS485 serial protocol and installed next to the smart (utility billing grade / NMI) meter.

What is now being asked of this meter under the draft determination is that that the device must be capable of sampling faster than 50ms (50ms is the maximum time interval), which is, to measure and calculate power factor via accurate power measurements and frequency readings, etc. The inverter will then need to poll the meter regularly to enable it to figure out whether it needs to export limit, ramp up the battery, etc. "regularly" varies a lot. It is likely to be slightly sub-second, but highly unlikely to be every 50ms. To be able to carry out the task at this higher frequency will require firmware updates and possible additional processing and storage capacity on the inverters internal communication hardware. There will also need to be a microprocessor on the monitoring device and some flash storage to allow for buffering of data and a small amount of local storage to allow for latency, again such a requirement is not part of current metering. All of this comes at a cost and a decision to divert technical and R&D resources to develop a response.

Currently there are no requirements for DER vendors to meter to 50ms levels of accuracy. There is a sampling response requirement of 100ms for voltage and frequency and 200ms for power thresholds in AS/NZS 4777.2:2020 but no requirements for data capture or recording.

[4] 2021 AEMO MASS – VPP Trial consultation industry responses

4. Location of the measurement point for FCAS

DER is always behind the meter, so it is the vector sum of the Customer load, Generation (typically PV), and DER response that determines the site level response. Measurement at the site level creates risks for VPP aggregators and reduces the visibility that AEMO has on the DER response. Based on these risks, measuring FCAS performance at the site level does not provide the same outcomes for VPP aggregators as measuring at the asset level. Furthermore, not all DER will behave the same. Some DER may charge a battery based on a short variation in frequency whereas another may discharge due to the characteristics of additional local loads, the net outcome being the measurement at the connection point may be far less accurate than assumed.

A primary concern in respect of measurement location appears to be driven by the risk of multiple assets enabled for FCAS at a single site, as well as a belief that measuring at the site and measuring at the device level provide the same outcome for VPP operators.

Ideally there should be an equal basis for DER and utility scale assets providing FCAS. At the utility scale, the connection point and device measurement point are one and the same. For behind the meter DER, they are not. This creates challenges for DER aggregators especially where there are multiple FCAS enabled devices at a single site as the aggregator must demonstrate suitable metering for each asset and must demonstrate that the performance of the multiple devices is complementary.

In the event that AEMO maintains site level verification, aggregators should also have the option of using device level data to confirm performance in the event that AEMO claims under-delivery (and this under-delivery is due to uncontrolled load or solar). Measurement at the AC terminals of the DER device, provides precision in measurement and accountability in terms or correctness of operation. Multiple assets at the site require their own metering response.

Measuring FCAS response at the connection point rather than at the battery inverter will add significant costs to VPPs. This will not be a good value proposition for customers. The upfront and ongoing costs would very likely exceed revenue from FCAS market participation. The result will be that VPPs do not participate in FCAS markets in future. If FCAS participation barriers are too high as compared to the available pool of value, the non-participation of DER, particularly as aggregated assets working in concert, has the potential to create system issues due to lack of visibility and effective control.

Performance should be verified at the point at which the FCAS service is delivered. Site-based control should require verification at the site. Asset level control should require verification at the asset.

We urge AEMO to consider the merits of measurement at the DER AC terminals rather than the NMI. This approach would mean that when multiple DER devices are installed behind one NMI they can all participate, which would help to address system upgrades where different DER may have different response times.

The issue of control of multiple devices behind the meter has been put forward as a rationale for measurement at the connection point. However, only one market ancillary services provider (MASP) can register a National Metering

Identifier (NMI). This should mitigate the issues and risks associated with measurement at the device, rather than at the connection point.

4.1 Measurement of grid flow

AEMO has requested confirmation of whether the grid flow is already captured when a hybrid system (battery plus PV) has been newly installed or where a battery system has been retrofitted, or would the grid flow only be measured if a site were participating in the FCAS markets?

A separate meter needs to be installed if an inverter requires export limitation or has a battery installed. The meter is not required to be revenue grade.

Grid flow is always measured. The issue is the frequency of capture.

5. Power system security concerns

Power system security concerns were introduced late in this review process as a barrier to amendment of the MASS particularly as the concerns raised seem to mostly be separate to concerns legitimate to the MASS and DER FCAS participation.

SolarEdge via close collaboration with the CEC has been working with AEMO to understand how to address the question of power system security concerns cited in the draft determination. If power system security concerns can be used to veto any other initiative between AEMO and the renewable energy industry, then it seems pointless to work with AEMO on anything other than power system security concerns. We therefore concur with the position of the CEC to commence this submission by responding to AEMO's power system security concerns and with a proposal for a process to address these concerns.

Additionally, if power system security concerns do exist and AEMO pursue the pathway to use such concerns (without fully testing and verifying the impact of new inverters complaint with the more rigorous response modes contained in AS/NZS 477.2:2020) then moving DER outside the scope of VPP and FCAS participation by creating costly and onerous requirements will create a self-fulfilling prophecy of lack of visibility and control. DER OEM's will simply view the technical requirements as simply not worth the effort in developing for such a small market on the global scale, additionally installers may see the installation requirements and obligations as too complex and system owners will simply not want to pay for all of this additional hardware and functionality in such a price sensitive market. Therefore, the inevitable outcome will be that more systems become installed outside of the scope of VPP's and AEMO visibility supporting system security risks in their own right.

Conversely if AEMO were to relax barriers and even go one step further to outwardly incentivize VPP and/or FCAS participation then the level of visibility and control, as well as accountability and governance offered under the

structure would directly be able to address system security concerns as well as build a much better understanding of the causes, effects and requirements to prevent any such issues moving forward.

5.1 Unexpected disconnection of inverters

The draft determination notes one potential risk is "unexpected disconnection due to a local network fault, and potential power system security risks in frequency recovery if the unexpected inverter disconnections are not properly accounted for".

SolarEdge is already very aware of AEMO's concerns regarding DER inverter behaviour during local distribution network faults and power system disturbances. Through the work of VDRT and lately FDRT which has now moved into the UNSW Project Match we have worked closely with AEMO to support the introduction of its short duration under voltage disturbance ride through (VDRT) test procedure, which has been mandatory in South Australia and on the Western Power network since 28 September 2020 and 1 July 2021 respectively and which will be mandatory in Victoria from 1 September 2021.

The revised test procedure will now be superseded when AS/NZS 4777.2:2020 commences from 18 December 2021. We estimate that bringing forward the date for compliance with the VDRT test procedure in advance of AS/NZS 4777.2:2020 has generally cost inverter manufacturers in the order of tens of millions of dollars in total for product changes and retesting of products.

We are already aware of three manufacturers whose inverters are listed on the CEC Approved Products List as compliant with AS/NZS 4777.2:2020. AEMO can access inverters compliant with AS/NZS 4777.2:2020.

Furthermore, SolarEdge is very willing to offer products already tested and certified, ahead of CEC listing to enable testing of their behaviour in response to power system disturbances. We do not foresee any obstacles to AEMO commissioning independent testing of these inverters over the course of this year to fully test and understand if the risk of unexpected behaviour by inverters will be satisfactorily addressed by the new inverter requirements.

5.2 The control hierarchy for inverters

The draft determination expressed concern regarding behaviour during local distribution network and global power system disturbances posing a risk of under-delivery of FCAS due to inverter requirements e.g. autonomous reactive power (Volt-Var response) support assisting voltage management in the distribution network prioritized over active power (FCAS response).

The prioritization table 2.6 in AS/NZS 4777.2:2020 (included below) does not stipulate prioritization level for FCAS response but it does specify priority for sustained active power response to frequency disturbances (prioritization level 4) ahead of power quality response modes like volt-var (prioritization level 5). Frequency support does sit below generation control functions like export limits (prioritization level 3), that will probably become dynamic/flexible in the future..

Table 2.6 — Specification for prioritization of inverter functions

Prioritization level	Description
1	All disturbance withstand limits described in Section 4 while abnormal conditions prevail and until the duration exceeds the time limits of the passive anti-islanding settings in Clause 4.4.
2	All requirements to operate the automatic disconnection device.
3	Generation control function of Section 6.
4	Sustained operation for frequency disturbances of Clause 4.5.3.
5	Inverter demand response mode of Clause 3.2 and power quality modes of Clauses 3.3.2 and 3.3.3 (see Note 1).
6	Power rate limit of Clause 3.3.4.
NOTE 1 The prioritization requirements for the power quality modes is defined in Clause 3.3.	
NOTE 2 The performance of the inverter when responding to demand response commands is defined in Clause 3.2.1.	

Source: AS/NZS 4777.2:2020

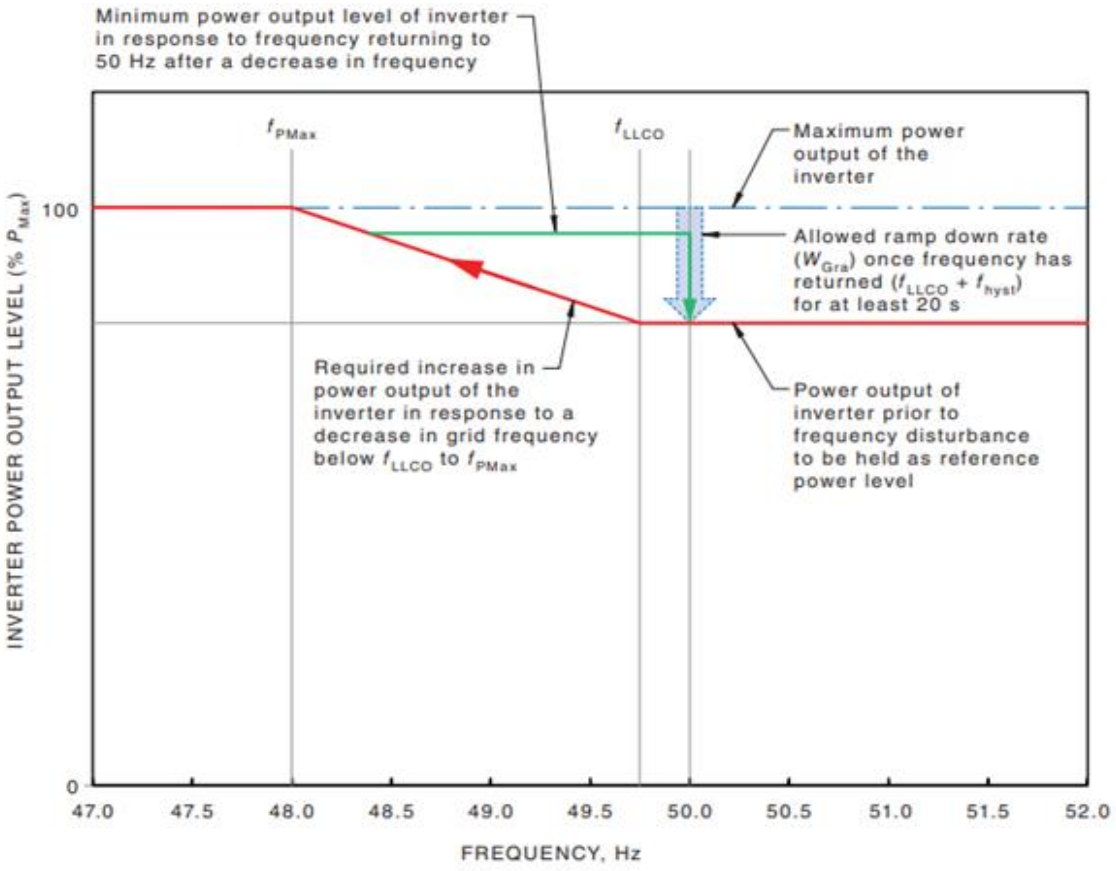

Figure 4.1 — Example frequency response for a decrease in frequency for an inverter that has a reduced output

Source: AS/NZS 4777.2:2020

So, when frequency falls below the continuous operation range, inverters are required to increase their output if it was previously curtailed by volt-var and/or volt-watt response modes as illustrated in figure 4.1. The test

procedure described in clause J.3.4, raises the voltage into the volt-watt region and then reduces frequency down below 48Hz to confirm this behaviour. This is a mandatory response.

Delivering an FCAS response in advance of this would not necessarily conflict with AS/NZS 4777.2:2020.

SolarEdge understands that these concerns were readily addressed in the South Australian VPP trials without any need to rewrite inverter standards.

5.3 Risks of exceeding the limits of secure network operations

The draft determination expresses concern regarding "risks associated with large-scale, rapid active power injection or withdrawal from deeply embedded assets (aggregated to provide FCAS) exceeding the limits of secure distribution network operation limits" and describes this as one of the risks "associated with the behaviour of DER inverters".

This is not a risk associated with DER inverter behaviour.

This is a risk associated with management of distribution networks.

In the short term, it could be managed with a process of registration of FCAS participants to ensure that no feeder is at risk of being overloaded.

5.4 Proposal for a process to address power system security concerns

SolarEdge, with its close relationship with the CEC recognizes that one of the key issues that AEMO is currently facing is the lack of reliable data from DER which can better help AEMO plan for the high DER scenarios.

This situation creates issues both for AEMO, and for SolarEdge as well as other industry stakeholders as this lack of consistent and accurate data with visibility into what is happening on the low voltage networks. This has resulted in rushed solutions and risk-averse policy and technical requirements being implemented over the last few years without valued industry consultation. The outcome is marginal results for AEMO at the expense of OEM's and system owners who ultimately bear the cost to comply.

The most telling example of this was the recent VDRT test requirements. These were released by AEMO and rushed through the South Australian Smarter Homes program in 2020 with limited consultation. This resulted in industry investing tens of millions in compliance costs. We have now been informed by AEMO that this test has been ineffective in solving for ride-through issues and has not created any noticeable system security outcomes. If AEMO had worked more closely with the industry, we could have worked through potential trials and offered data to help develop the same level of outcome with minimal expense and lack of negative industry impact.

During the VPP Demonstrations trial, AEMO developed an application programming interface (API) to capture real-time fleet and asset level data from VPP participants and DER that had previously been invisible to AEMO. This data

was invaluable for fault detection and forecasting behaviour, however AEMO has opted not to maintain the API. This is a perplexing decision and raises concerns about the future alignment of AEMO processes with DNSPs who are primarily looking at API-based interfaces. If AEMO uses a different system for asset visibility, forecasting and dispatch, it is unclear how this is can be properly coordinated with the work being done by DNSPs and OEM's.

SolarEdge support the CEC proposal to set a joint work program to both address DER specific power system security concerns, and better understand the data needs of AEMO. The process should look at all the ongoing work that AEMO has underway currently that would benefit from DER datasets (such as Project Match and Project Edge as priorities) as well as identifying key data gaps and potential concerns from AEMO's perspective.

This joint DER data work program could then be presented to the broader industry with clearly defined goals and measurable outcomes clearly outlined and prioritized.

As a starting point this forum could be used to convene DNSPs, industry and AEMO to better understand the power system security concerns flagged in the MASS Draft Determination to hopefully enable full DER market development.

This collaborative approach will naturally lead to a better articulation of the data needs of AEMO and understanding how industry can better support.

SolarEdge welcomes the proposal to establish a Consultative Forum as a vehicle for industry collaboration between AEMO and interested stakeholders.

6. Fees for registering/de-registering NMIs for VPP

Fees for de-registering and registering National Metering Identifiers (NMIs) are applicable.

Under the proposed rules, VPPs would incur normal market registration fees ($2,800) each time they need to amend their portfolio.

Fees for adjusting registration should only be applicable when the Dispatchable Unit Identifier (DUID) changes, not for individual NMIs – and then the cost should reflect the administrative time required rather than the standard registration fee.

The approach needs to consider DER assets potentially in the tens of thousands were end users may move house or decide to upgrade or replace a system. They could also move internet provider or retailer, therefore the registering/de-registering fee's NMIs for VPP's need to be carefully considered so that participation barriers or disincentivizing to participate becomes the predominant factor.

SolarEdge sees a pragmatic approach here with allowing VPP aggregators or operators to be contracted at committed levels and enabled to manage the pool of resources that respond to this contractual commitment. This can remove the need for registration at the site level and remove an administrative burden that could quickly absorb any of the FCAS value pool available. This would also enable flexibility in consumer choice to shift VPP contracts, reflecting the freedoms of choice consumers have in Retail Electricity markets.

7. Recommendations

1. AEMO should proactively look to establish a Consultative Forum via the CEC with AEMO as a vehicle for collaboration between AEMO and interested stakeholders.

2. AEMO should review its laboratory test requirements for FCAS registration and whether they are sufficient to detect the oscillatory behaviour as reported by Reposit (only).

3. AEMO should maintain the 1s sampling rate for DER inclusion in fast FCAS markets, removing a key barrier to entry for DER participation. This can be effectively introduced following methods used internationally using smaller sample rates during test verification prior to registration and 1s sampling for operation.

4. AEMO should consider aligning as much as possible with the DER technical specifications of AS/NZS 4777.2:2020.

5. Analysis based on the minimum cost of an FCAS-compliant meter should assume a price of $1350 - $2000 instead of the $120 estimate cited in earlier submissions to AEMO.

6. AEMO should accelerate the testing the behaviour of inverters compliant with AS/NZS 4777.2:2020 and consider formalizing the program with a Memorandum of Understanding.

7. AEMO should specify compliance with AS/NZS 4777.2:2020 for all systems upon registration for FCAS.

8. AEMO should consider the measurement for FCAS at the DER AC terminals rather than the NMI.

9. AEMO should work closely with OEM's to understand in more detail which aspects of AS/NZS 4777.2:2020, if any, could have an adverse effect on FCAS delivery, and how best to balance different priorities.

10. AEMO should work with DNSPs and other industry stakeholders on measures to mitigate the risk of exceeding the limits of secure distribution network operation limits during FCAS response.

11. Fees for adjusting registration should only be applicable when the Dispatchable Unit Identifier (DUID) changes, not for individual NMIs, the cost should reflect the administrative time required only.

James Sturch B(Hons), GCertAPVI, PGDipBA
Technical Director
Rest of World Region

Alan Coller LLM, MBA, FAIE, GAICD
Director, Energy Services
Australia & New Zealand

SolarEdge Technologies (Australia) PTY LTD.
33 Agnes Street,
East Melbourne VIC 3002
ABN: 15 165 506 712