Submission to AEMO Public Consultation Report
Technical Requirements for 200 kW to 5 MW DER Connections

1 Introduction

1.1 General

This submission provides comments on the Australian Energy Market Operator (AEMO) Public Consultation Report *Technical Requirements for 200 kW to 5 MW DER Connections*, Version #1 released 2 September 2024 (hereafter the "Consultation Report").

The report is a timely and valuable initiative which has significant potential to facilitate the more economic integration of distributed energy resources (DER) into the Australian electricity system while improving overall technical performance.

The stated aims of:

- facilitating greater volumes of DER in the market;
- providing certainty and consistency;
- minimising costs of technical requirements;

are strongly supported. Indeed, the benefits of having clear and consistent requirements across as much as Australia and across as many technical subject areas as possible are difficult to overstate. As such, it is recommended that any technical requirements specification document developed for < 5 MW DER (hereafter "Requirements Document") should consider not just requirements related to the operation of the bulk power system but also include and harmonise as many other requirements as possible, such as those typically determined by distribution network service providers (DNSPs). To not do so would be a lost opportunity and only mean that further work will be necessary in this regard at a future time.

1.2 Main Points of this Submission

As a broad summary, this submission recommends that the Requirements Document to be developed be:

- an Australian Standard;
- expanded from what is suggested in the Consultation Document to cover as wide a range of technical requirements as possible, including those more of interest to DNSPs;
- co-ordinated with AS/NZS 4777, potentially requiring amendments to that standard, so that it is clear which requirements apply to which sizes and arrangements of DER.

2 Prospective Performance Requirements (Section 2)

2.1 Other Requirements

Specific AEMO consultation questions:

> *Should AEMO also consider any or all of the requirements outlined in Section 2.5 (identified by AEMO as being of interest to DNSPs only)?*
>
> *Should AEMO consider other requirements not outlined here?*

Whatever Requirements Document is ultimately developed should absolutely include other technical requirements, not just those relating to the operation of the bulk power system. Having a document that clearly sets out as may technical requirements as possible would greatly assist the uptake of DER in Australia and provide greater certainty and consistency for all sectors of the industry, with associated reduced costs and increased compliance. Given the increasing importance of DER to electricity supply in Australia, with its clear economic and environmental benefits, having a single, clear document that specifies all or most technical requirements will have very substantial benefits.

Technical requirements which should also be considered include:

- reactive power requirements;
- P(U) requirements (volt-watt);
- primary and backup protection settings (refer Section 2.2 below);
- modelling requirements, including when modelling is not (normally) required.

Where it is not possible to specify technical requirements for some reason, recommended settings, or at least technical guidance of how to choose settings, should be included.

2.2 Protection Settings

Section 2.1.3 of the Consultation Report discusses the fact that protection can often be set to achieve greater disturbance ride-through than the minimum specified. However, determining appropriate settings is not a simple matter and there is little in the way of guidance available. This is further complicated by the fact that it is not a straight technical issue but involves a trade-off against the risk of an unintentional island being formed. It is clear that even many protection engineers in DNSPs do not have a good understanding of this issue and that the loss-of-mains (LOM) protection settings adopted are simply taken from AS/NZS 4777, so that the minimum ride-through values simply become the de facto LOM protection settings.

To help overcome this, actual LOM protection settings should be specified, or at least recommended, in the proposed Requirements Document. If this is not possible in some cases then guidance should be included as to how to determine appropriate settings. Otherwise it seems clear, based on present experience, that the minimum ride-through requirements will be adopted in most cases as the LOM protection settings.

3 Proposed Performance Requirements (Section 4)

3.1 LV DER < 1.5 MW

Specific AEMO consultation question:

> *What are stakeholder perspectives on the application of AS/NZS 4777.1 and AS/NZS 4777.2 region-based requirements, for 230/400 V ac IES, less than 1.5 MW aggregate rated capacity, connected to the HV distribution network with LV load?*

It is first noted that it is not clear from where the value of 1.5 MW comes, as it is not discussed in the Consultation Report. One possible origin is that it reflects the system size at which central inverters would start to be used instead of string inverters. If this is the case then it is suggested the value is somewhat on the low side and a figure of 2 MW might be more appropriate.

In any event it is accepted that the range of system sizes covered by the Consultation Report, from 200 kW up to 5 MW, will almost certainly require some additional requirements for system sizes above 1.5 MW (or other appropriate figure). However, there would seem to be no need to have more than two size ranges.

A second point is that the scope of AS/NZS 4777.2 is not completely clear. In Section 1.1.1 "Scope" the standard states that it "may be used for low voltage installation of systems that may be connected to the grid at high voltage". It is not clear from this who decides whether AS/NZS 4777.2 is to be used for LV installations in a private HV network. The proponent? The DNSP? Is it meant to be that the subsequent paragraph in AS/NZS 4777.2 - that it does not apply to DER connected to dedicated HV systems with no local load - implies that it does apply to DER connected at HV with local load? This would not seem to be supported by a typical reading of the text.

A further point is that the differentiation between LV and HV systems is not fundamentally based on different technical requirements for the two but rather on who owns the connecting electrical infrastructure. All LV DER connected to the NEM will have a HV (in the AS/NZS 3000 sense of greater than 1000 V) connection, it is just that the connecting assets are owned by a DNSP - there will still be a transformer, MV switchgear etc. It seems incongruous that two systems could be exactly the same but subject to different technical requirements simply because the MV connection assets are owned by different entities.

Given the above, consideration should be given to a more clearly delineated scope between AS/NZS 4777 and the proposed Requirements Document. This could be that the scope of AS/NZS 4777 is limited to DER systems less than 1.5 MW (or other determined figure) and that the Requirement Document's scope covers from 1.5 MW (or other determined figure) up to less than 5 MW. Any requirements identified in the Consultation Report applicable to < 1.5 MW could be included in AS/NZS 4777 in a future revision. Such an arrangement would improve certainty and consistency and hence aid the economic roll-out of DER.

3.2 Other References

Specific AEMO consultation question:

> *Should AEMO consider other references for its technical performance settings? For example, EN 50549-2:2019, which specifies the technical requirements for the*

protection functions and the operational capabilities for generating plant intended to operate in parallel with MV distribution networks.

Any suitable source should be considered in determining appropriate technical requirements for < 5 MW DER. However, any requirements from other sources should be embedded in the proposed Requirements Document rather than being called up by reference. It should not be necessary to obtain and search through multiple documents to determine the applicable technical requirements.

If the question is more general in asking whether other requirements, not covered in IEC TS 62786-1, should be included in the proposed technical document then yes, that would be clearly beneficial - refer Section 2.1 above.

4 Implementation Approach (Section 5)

4.1 Australian Standard?

Specific AEMO consultation question:

Should the recommended settings be established as an Australian Standard?

The implementation of settings for < 5 MW DER as an Australian Standard is strongly supported. The establishment of an Australian Standard would have a number of benefits, including:

- alignment with what is already implemented for LV DER; that is by an Australian Standard (AS/NZS 4777). The industry as a whole is already familiar with and working under such an arrangement and has a long history of using Australian Standards.
- involvement of a range of parties in the development of Australian Standards. This not only can result in better outcomes by incorporating a range of views from different perspectives but represents a document developed by the industry rather than perhaps being seen as being imposed on it.
- inclusion of topics that might otherwise not be on interest to AEMO and/or DNSPs but that could help achieve the stated goals of facilitating integration of DER, providing consistency and minimising cost.
- an Australian Standard could be applied in regions outside the National Electricity Market.
- Australian Standards have well-developed systems for their initiation, development, review and revision.
- an Australian Standard is perhaps seen as having more "moral force" than a document developed by one or a small number of parties. This could aid acceptance and on-going compliance.
- providing increased certainty and consistency for the industry, knowing that there is a defined procedure for any revision of the requirements that facilitates input from many sectors via their representation on the relevant Standards Australia technical committee.

With specific regard as to whether it would be best to have a modified adoption of IEC 62786-1 or to have a specific Australian Standard, it would seem best to develop a specific Australian Standard, for the following reasons:

- any Australian adoption of IEC 62786-1 will require, as a minimum, substantial re-writing of IEC 627686-1.
- it is not clear that IEC 62786-1 was ever meant for country-specific adoption, as opposed to just serving as a base for the issues that needed to be covered. The wording is very generic and will need significant modification.
- it is noted that Europe and the USA have not adopted EC 62786-1 but have their own specific standards.
- it would be easy to overcome any issue of non-alignment with international standards by simply making sure that any Australian Standard that was developed complied with the principles set out in IEC 62786-1 - it is not necessary to adopt the actual text. It is further noted that IEC 62786-1 does not have the status of an international standard but rather a technical specification and does not deal with equipment specification but rather only setting parameters. The risk of non-alignment with international standards is low to non-existent.
- Australia is in many ways at the forefront of mass installation of DER and hence will likely come across issues, and need to address them, before other countries. Having

a specific Australian Standard will help facilitate and speed up this process. The Australian experience can then be used by the IEC to improve their documents.

- a specific Australian Standard will be clearer than a modified IEC document, as any modified adoption will have numerous additions and deletions and it is likely that important requirements will need to be relegated to annexes.

4.2 Initial Guideline

Specific AEMO consultation question:

> *Is initially introducing the proposed recommended settings via a guideline with DNSPs the most effective approach?*

It is not fully clear what is proposed. It seems to be that AEMO and DNSPs would publish an initial guideline that would at some future date be replaced by an Australian Standard. If this is the intention then it would seem to have a number of drawbacks, including:

- the initial guideline would not have the advantages listed above for an Australian Standard, particularly input from and ownership by a range of industry sectors.
- there is no guarantee that the relevant technical committee responsible for the future Australian Standard would not make changes to at least some of the settings in the initial guideline.
- it would mean there would be at least two different documents issued within a short time period, the initial guideline and the subsequent Australian Standard.
- the time spent developing the initial guideline would seem to be better spent working with the relevant Standards Australia technical committee in developing the future Australian Standard.

In short, the development of an initial guideline would not help with the stated aim of providing increased certainty and consistency for the industry.

If the above is not what is actually being proposed but rather that there would remain two separate documents, a document with the actual settings (the initial guideline, developed and maintained by AEMO and DNSPs) and an Australian adoption of IEC TS 62786-1 (maintained by technical committee EL-064), then again there would seem to be a series of issues. The most obvious is that requirements would be spread across two different documents. If this were the case it would seem better just to have the initial guideline with the settings and not formally link it to IEC TS 62786-1. All the information could then be contained in just the one document.

4.3 Relationship with AS/NZS 4777

In Section 5.1.1 of the Consultation Report it is stated that "The guideline would detail . . . any additional settings for plant 200 kW to <5MW for which AS 4777.1 would apply".

This seems to indicate that, for some LV connections, requirements for DER would be spread across two different documents, AS/NZS 4777.1 and the proposed Requirements Document. This can not possibly help clarity and hence compliance and risks getting the two documents out of step. If there are requirements that need to be included in AS/NZS 4777 then this should be done by amending the standard.

See also Section 3.1 above.

5 Proposed Settings (Section 4 and Appendix A1)

5.1 Frequency Response Settings

It is noted that the proposed frequency response setting given on page 68 of the Consultation Report for mainland Australia of droop of 4% does not match the proposed performance level of 5%. This is assumed to be to match the requirements specified in AS/NZS 4777. However, the deadband proposed in the Consultation Report is 49.5 to 50.5 Hz. This differs from that specified in AS/NZS 4777.2 for the corresponding region (Australia A) of a deadband from 49.75 to 50.25 Hz. This means that the exact same string inverter installed in the mainland NEM will need to have different settings depending if the site is supplied at high voltage or low voltage. Given the efforts in recent years to improve compliance by standardising settings, this seem very undesirable.

This issue could be overcome by aligning the proposed settings with AS/NZS 4777. Alternatively, it could be mitigated by specifying that the AS/NZS 4777 settings apply to all string inverters and the Consultation Report settings apply to central inverters. The issue could also be mitigated if it were decided that AS/NZS 4777 settings applied up to 1.5 MW (or other determined value) and the Consultation Report settings applied above that up to 5 MW, refer Section 3.1 above.

5.2 Rated Voltage

The voltage excursion ride-through performance level and proposed settings on page 62 of the Consultation Report specify a continuous voltage withstand of 110%. Thus a nominal 22 kV system would have to be able to operate at a continuous voltage of 24.2 kV. However, the rated voltage for a 22 kV system is 24 kV and thus would not technically comply. While it should be relatively straightforward to demonstrate compliance for air-insulated equipment, it would be very difficult in most cases to demonstrate compliance for non-air-insulated equipment such as cables, transformers and most switchgear. The only clear way of demonstrating compliance would be to use equipment with the next highest voltage rating, with the associated cost implications.

While in practice this issue is likely to be ignored in the vast majority of cases, it would be naive to assume that no one anywhere in Australia will ever ask for a project to demonstrate compliance or to certify that the project meets all relevant Australian Standards and regulations. It would seem much easier to simply reduce the requirement to 1.09 per unit, to provide increased certainty and consistency.

5.3 Connection Pont vs. Terminal Quantities

Section 4.1.1 of the Consultation Report discusses the use of measurements made at the connection point versus those at the inverter terminals for performance evaluation. This same issue also applies to control and protection.

As the frequency will be the same throughout the system, any frequency-based measurement will be the same whether it is made at the connection point or the inverter terminals and thus it does not matter where it is made. It is thus recommended the Requirements Document specifically state that frequency measurements can be made at any suitable point in the system.

With regard to voltage measurement, the discussed options of using either a steady state RMS model or a dynamic model would add considerable complexity and hence expense. It should therefore be considered whether any resulting increased technical performance would be sufficient to justify the additional expense.