INTER-NETWORK TEST GUIDELINES

FINAL REPORT AND DETERMINATION

Published: **September 2021**

Australian Energy Market Operator Ltd ABN 94 072 010 327 www.aemo.com.au info@aemo.com.au

NEW SOUTH WALES QUEENSLAND SOUTH AUSTRALIA VICTORIA AUSTRALIAN CAPITAL TERRITORY TASMANIA WESTERN AUSTRALIA

EXECUTIVE SUMMARY

The publication of this Final Report and Determination (Final Report) concludes the consultation by AEMO on revised Inter-Network Test Guidelines (Guidelines) under clause 5.7.7(k) of the National Electricity Rules (NER).

The final Guidelines published with this Final Report are effective immediately, replacing the 'Inter-Network Test Initiation Guidelines' made in February 2008 by the Inter-regional Planning Committee, which no longer exists.

AEMO's formal consultation process commenced on 18 May 2021 with an Issues Paper that was developed using feedback from a pre-consultation workshop organised in February 2021 to facilitate discussion on the proposed changes.

A draft report and determination was published on 26 July 2021, with a number of clarifications to the draft Guidelines after considering feedback from Powerlink. AEMO received one submission on the draft report, from ElectraNet, and held meetings with both ElectraNet and Powerlink.

As a result of feedback received from ElectraNet and Powerlink, the final Guidelines incorporate further clarifications relating to the:

- Inter-network testing governance arrangements.
- Active monitoring of power system performance as part of inter-network test programs.

In addition, the final Guidelines include a number of administrative amendments, minor clarifications and wording changes. A mark-up of the changes between the draft and final Guidelines is also published with this Final Report.

The final Guidelines determined by AEMO will provide more effective and useful guidance on the application of essential aspects of NER clause 5.7.7. In addition to a general review and update from the 2008 guidelines, the revised Guidelines incorporate the following improvements:

- A governance structure for assessment, planning and coordination of inter-network tests, particularly for major projects.
- Fit-for-purpose assessment criteria to determine when inter-network testing will be required for a project.
- Inclusion of project examples.
- Power system disturbance methods for testing purposes, including a risk assessment approach.
- An overview of the approach to model development associated with developing future study cases to support assessment of interconnector upgrades.

CONTENTS

1. STAKEHOLDER CONSULTATION PROCESS

AEMO has consulted on the updated Inter-Network Test Guidelines (**Guidelines**) in accordance with the Rules consultation procedures in rule 8.9 of the NER.

The timeline followed by AEMO for this consultation is outlined below.

Deliverable	Date
Issues Paper published	17/5/2021
Submissions due on Issues Paper	22/6/2021
Draft Report published	26/7/2021
Submissions due on Draft Report	11/8/2021
Final updated Guidelines and Final Determination published	24/9/2021

The publication of this Final Determination marks the conclusion of the consultation.

The final version of the updated Guidelines is published with this Final Determination.

2. BACKGROUND

2.1. NER requirements

Under clause 5.7.7(k) of the NER, AEMO may develop, publish and amend guidelines to assist Registered Participants to determine when an inter-network test may be required. The Guidelines may be made or amended in accordance with the Rules consultation procedures set out in NER rule 8.9.

For these Guidelines to be effective and useful, AEMO considers they should include explanation and process guidance on the application of the essential aspects of clause 5.7.7 including:

- Application of the material inter-network impact (MINI) criteria to determine when Inter-Network Testing is required.
- Supporting information and guidance regarding governance and processes to meet the requirements of clause 5.7.7.
- Practical examples of how the Guidelines may be applied.

2.2. Context for this consultation

AEMO considered it was timely to review the Guidelines for the following reasons:

- The existing Guidelines were published in 2008 under the Inter Regional Planning Committee (IRPC) (which no longer exists), and the National Electricity Market (NEM) power system and its interactions have changed significantly since that time.
- The 2020 Integrated System Plan (ISP) Central scenario predicts an additional 6 gigawatts (GW) of interconnector capacity will be needed over the next 20 years[1]. The majority of these upgrades will have a material impact on the power system and necessitate a coordinated approach to testing and release of new capacity to the NEM. It is therefore prudent to maintain the currency and usefulness of the Guidelines.

[1] See https://aemo.com.au/-/media/files/major-publications/isp/2020/appendix--3.pdf?la=en

2.3. Proposed changes

As discussed in the first stage consultation Issues Paper, AEMO proposed to amend and expand the existing Guidelines in the following key areas:

- General review and update.
- Proposed governance structure to progress interconnector projects.
- Improved, fit-for-purpose assessment criteria to determine when inter-network testing will be required for a project.
- Inclusion of project examples including a description of how clause 5.7.7 is assessed and applied.
- Power system disturbance methods for testing purposes, including a risk assessment approach.
- An overview of the approach to model development associated with developing future study cases to support assessment of interconnector upgrades.

2.4. Pre-consultation workshop

To inform its development of amended Guidelines, AEMO organised a workshop on 2 February 2021 and invited representatives from TransGrid, Powerlink, TasNetworks, ElectraNet and AEMO's Victorian planning function. Ahead of the workshop, AEMO shared a pre-workshop questionnaire seeking input on key areas of the Guidelines.

At this workshop, AEMO shared an initial draft of the proposed Guidelines with attendees for comment. The comments received at this initial workshop and pre-workshop questionnaire helped to inform the contents of the Guidelines published for the first stage of consultation.

2.5. First stage consultation

On 17 May 2021, AEMO issued a Notice of First Stage Consultation and published an Issues Paper and initial draft amended Inter-Network Test Guidelines. This information is available on AEMO's website at: https://aemo.com.au/en/consultations/current-and-closed-consultations/inter-network-test-guidelines.

The Issues Paper included a summary of the proposed changes.

In response, AEMO received one submission from Powerlink. AEMO also held one meeting with Powerlink. AEMO published Powerlink's submission on AEMO's website at: https://aemo.com.au/en/consultations/current-and-closed-consultations/inter-network-test-guidelines.

2.6. Second stage consultation

AEMO published its Draft Determination[2] on 26 July 2021 outlining its response and determination to each issue raised in the first stage consultation.

In response, AEMO received one submission from ElectraNet. AEMO also held two meetings, a follow-up with Powerlink and a meeting with ElectraNet to discuss their submission. AEMO published ElectraNet's submission on AEMO's website at: https://aemo.com.au/en/consultations/current-and-closed-consultations/inter-network-test-guidelines.

AEMO's Final Determination is to amend the Inter-Network Test Guidelines in the form published with this Final Determination.

[2] Available at https://aemo.com.au/consultations/current-and-closed-consultations/inter-network-test-guidelines

3. SUMMARY OF MATERIAL ISSUES

The key topics arising from the proposal and raised by Consulted Persons in the stage one and stage two consultation are outlined in Table 1 and detailed in section 4 of this Final Determination.

Table 1 Listing of material issues arising from submissions received

No.	Issue	Raised by
1	Inter-Network Testing governance arrangements	Powerlink
2	Application of Material Inter-Network Impact (MINI) criteria to actionable ISP projects	Powerlink
3	Prudent and efficient Inter-Network Testing	Powerlink
4	Power system model requirements	Powerlink
5	Achieving conditions for Inter-Network Testing	Powerlink
6	Post-test reporting requirements	Powerlink
7	Clarification of Inter-Network Testing governance arrangements	ElectraNet
8	Active monitoring of power system performance as part of inter-network test programs	ElectraNet
9	Testing delays impacting release of capacity	ElectraNet
10	Minor clarifications and suggested wording changes	ElectraNet

4. DISCUSSION OF MATERIAL ISSUES

4.1. Inter-Network Testing governance arrangements

4.1.1. Issues summary and submissions

Section 3.2 of the proposed Guidelines outlines the governance structure consisting of a System Integration Steering Committee (SISC) and associated workstreams for addressing the requirements of undertaking an inter-network test. This proposed structure is centred around establishing a SISC with relevant representation from the Proponent, the Relevant Transmission Network Serviced Provider (TNSP) and AEMO. The Guidelines also outline the key activities expected to be undertaken by the SISC and how the SISC may interact with other working groups, reference groups and committees.

Powerlink expressed concerns that the proposed structure could be too prescriptive to apply across all projects involving inter-network testing. Powerlink recommended a more flexible approach which proposes but does not mandate the SISC structure. Powerlink also suggested that, for less complex projects, the Guidelines could specify tasks/processes that need to be fulfilled only.

4.1.2. AEMO's assessment

AEMO believes any governance structure would normally contain representatives from the Proponent, the Relevant TNSP and AEMO. This represents the key parties who are likely to be impacted by any project that has been assessed to have a MINI.

As acknowledged in Powerlink's submission, AEMO notes that:

- The proposed Guidelines state that the SISC may determine whether workstreams should be combined or divided. This allows the SISC to reduce the number of workstreams/teams required as appropriate.
- The proposed Guidelines outline the responsibilities of the workstreams that sit under the SISC.

4.1.3. AEMO's conclusion

AEMO revised the wording in Section 3.2 to make it clear that the number of representatives and workstreams in each SISC should be suitable for the associated project. AEMO's final Guidelines include updated wording to make it clear the SISC can define alternative workstream structures to enable the SISC to fulfil its functions.

In addition, after discussions with the Executive Joint Planning Committee (EJPC), AEMO updated the governance structure to reflect the formation of an Inter-Network Test Reference Committee (INTRC), which provides oversight to project SISCs and reporting to the EJPC and National Electricity Market Operation Committee (NEMOC) in relation to 5.7.7 responsibilities. The INTRC replaces the previously proposed JPC sub-committee in the draft Guidelines.

4.2. Application of MINI criteria to ISP projects

4.2.1. Issues summary and submissions

The separately published MINI criteria[3] are applied to determine whether inter-network testing may be required for a particular project. The proposed Guidelines included wording in section 4.2 to establish that all actionable ISP projects are taken to have a MINI for the purposes of clause 5.7.7 and the Guidelines.

Powerlink noted that rule 5.21 of the NER requires AEMO to publish criteria to assess whether a proposed transmission network augmentation is reasonably likely to have a MINI, but considered this does not apply to actionable ISP projects as a result of clause 5.21(a). Powerlink recommended that the Australian Energy Market Commission's (AEMC's) next minor update to the NER should clarify the treatment of actionable ISP projects and whether their network impacts should be assessed using the MINI criteria.

4.2.2. AEMO's assessment

AEMO agrees with Powerlink that the application of the MINI criteria to actionable ISP projects would benefit from clarification in the NER. Given that clause 5.7.7 applies to actionable ISP projects, however, AEMO's proposed Guidelines notes:

- "By virtue of their size and impact on the power system, all actionable Integrated System Plan (ISP) projects should be assessed as to whether they have a MINI."

4.2.3. AEMO's conclusion

AEMO understands that Powerlink broadly supports that the Guidelines have appropriately captured how to assess actionable ISP projects under the existing NER, and made no additional changes. In principle AEMO would support a rule change proposal to clarify the specific elements of rule 5.21 that are not applicable to actionable ISP projects.

4.3. Prudent and efficient testing

4.3.1. Issues summary and submissions

Section 4.3 of the proposed Guidelines set out considerations for assessing whether a project that has a MINI triggers a requirement for inter-network testing. The proposed Guidelines also contemplated a path to concluding that an inter-network test is not required for a project that has been identified to have a MINI.

[3] MINI Criteria published as Appendix 2 of the *Final Determination: Criteria for Assessing Material Inter-Network Impact of Transmission* Augmentations, Inter Regional Planning Committee, 21 October 2004. Available at: https://aemo.com.au/-/media/files/electricity/nem/network_connections/transmission-and-distribution/170-0035-pdf.pdf

Powerlink raised concerns that for certain projects there may be no practical advantage in requiring an inter-network test to be carried out. Powerlink considered the proposed Guidelines were too prescriptive in this area and this could result in network testing which increases project costs without being in the interest of electricity customers.

Powerlink also made a suggestion relating to Section 4.4(a)(iii), which states: "If any one of the Relevant TNSP(s), AEMO or the Proponent considers that an inter-network test is required then the JPC must not approve the recommendation and an *inter-network test* will be conducted under NER clause 5.7.7." Powerlink suggested that where an agreement cannot be reached, the issue of whether testing is required should be referred to the Joint Planning Committee (JPC) for decision.

4.3.2. AEMO's assessment

AEMO agrees with Powerlink that network testing should only be carried out when it is reasonable and in the interests of electricity consumers to do so. In developing the proposed Guidelines AEMO had sought to address this issue:

- Section 4.3 contains a non-exhaustive list of considerations for determining whether there is a requirement and benefit to undertake *Inter-network tests*.
- Section 4.4 outlines a high-level process that is to be followed when a project is identified to have a MINI but where AEMO or the *Relevant TNSP* conclude that an *inter-network test* is not required for a project.

4.3.3. AEMO's conclusion

AEMO shares Powerlink's concerns, and the Guidelines outline a process for AEMO and the relevant TNSPs to assess the need for inter-network testing, which should ensure that the testing requirements are appropriate for each project. This process allows the Inter-network Test Reference Committee (INTRC) to review the assessment of the requirement for testing and approve (if appropriate) and document the decision, consulting with the Executive Joint Planning Committee (EJPC) where necessary.

AEMO agrees with Powerlink's suggestion that where agreement cannot be reached on whether inter-network testing is required it should be referred to the INTRC for a final decision. Section 4.4 of the Guidelines was amended to reflect this.

4.4. Power system model requirements

4.4.1. Issues summary and submissions

Section 6.1 of the proposed Guidelines outlined general modelling requirements when assessing a project's impact on the power system. This section also described the modelling requirements for the installation of new systems and equipment.

Powerlink raised a concern that section 6.1(e) appears to imply that R2 models of new systems and equipment must be available before commencement of an inter-network test. Powerlink considered this requirement could unduly delay the testing and release of capacity and potentially add to system costs. Powerlink recommended that, at a minimum, R1 models and parameters are available during the preparation phase and R2 should be available for the later hold point testing. For new systems and equipment, Powerlink suggested it would be appropriate to progress the initial testing phases using R1 models and parameters.

4.4.2. AEMO's analysis

AEMO agrees that the guidelines should appropriately reflect the status of modelling information at the time of commencing inter-network tests.

4.4.3. AEMO's conclusion

AEMO amended the wording in section 6.1(e) of the Guidelines to avoid any unintended implication that all R2 data must be available prior to an inter-network test.

4.5. Achieving conditions for Inter-Network Testing

4.5.1. Issues summary and submissions

Section 8 of the proposed Guidelines described options for achieving the network conditions necessary to carry out an inter-network test as outlined in a project's test program. The Guidelines explain that a Proponent can wait for network conditions to match the test program's requirements or alternatively at the Proponents cost, procure test facilitation services as contemplated in NER clause 5.7.7(u).

Powerlink submitted that the proposed Guidelines should not set an expectation that test facilitation services that are normally free need to be procured at a cost.

4.5.2. AEMO's analysis

AEMO agrees that the Guidelines should not set an expectation that test facilitation services must always be paid for.

4.5.3. AEMO's conclusion

Section 8 of the Guidelines was amended accordingly.

4.6. Post-test reporting

4.6.1. Issues summary and submission

Section 10 of the proposed Guidelines included a requirement for post-test reporting where the *P*roponent must report on test results and observations. The post-test report must include:

(i) a description of each component of the test performed;

(ii) the test results and comparison with computer modelling relied upon for the production of the test regime;

(iii) the new safe network limits verified by the test for power system security;

(iv) a comparison of the new limits achieved compared with the limits proposed in the approval document for the Project (for example, the project assessment conclusions report); and

(v) a description of any including issues encountered during testing and recommendations for future testing activities.

Powerlink was concerned that item (iv) in the above list represents an ex-post analysis of the performance anticipated through the regulatory investment test for transmission (RIT-T) process. Powerlink suggested that if this kind of analysis is required, the Australian Energy Regulator (AER), rather than AEMO, is the appropriate body to request this information.

4.6.2. AEMO's analysis

AEMO considers that such reporting would be useful but not necessary for the purposes of the Guidelines.

4.6.3. AEMO's conclusion

AEMO amended Section 10 of the draft Guidelines to remove item (iv).

4.7. Clarification of governance arrangements

4.7.1. Issues summary and submission

The draft Guidelines included an example governance structure and suggested workstreams/responsibilities to be addressed as part of fulfilling the obligations of testing under 5.7.7. The draft Guidelines also included a reporting structure for each project's SISC, with the SISC reporting to the INTRC and the INTRC assisting project SISCs with meeting their obligations.

ElectraNet proposed that the SISC should report to the PJPC, rather than the INTRC. ElectraNet suggested the INTRC should have more of an advisory role.

ElectraNet wanted the Guidelines to be clearer on who the SISC is accountable to and who approves the SISC's terms of reference.

ElectraNet also suggested a new customer connections workstream be included in the high level workstream structure outlined in the Guidelines. In addition, ElectraNet highlighted that government relations should be considered in the external communication workstream's suggested responsibilities.

ElectraNet also commented on some specific areas of the Guidelines and provided suggested changes to address feedback raised in their submission.

4.7.2. AEMO's analysis

AEMO considers that the INTRC is necessary in its current form in the context of 5.7.7 obligations and notes that its role has been defined with input from the TNSPs and the EJPC. SISC member organisations can work directly with the EJPC when deemed necessary however, establishment of the INTRC provides a framework for fulfilling 5.7.7 obligations.

AEMO agrees with ElectraNet that the Guidelines would benefit from further clarification on the SISC's reporting lines and who approves the SISC's terms of reference.

The purpose of the workstream structure included in the Guidelines is to highlight key activities that are likely to be carried out when planning for and conducting inter-network tests. Each SISC can define/change the workstream structure or responsibilities as appropriate based on project specific requirements. AEMO agrees that including a reference to the customer connections workstream and government relations responsibilities would be beneficial.

4.7.3. AEMO's conclusion

Following consideration of ElectraNet's submission, AEMO has updated the Guidelines as outlined below:

- Added clarifications that the reporting structures outlined in the Guidelines are related to 5.7.7 obligations.
- Clarified the SISC's reporting lines, noting that executives of SISC member organisations may be required to approve the relevant project terms of reference.
- Updated the workstream descriptions based upon feedback from ElectraNet's submission.
- Made additional minor updates to address ElectraNet's specific suggestions relating to governance arrangements.

4.8. Active monitoring and organic fault occurrence

4.8.1. Issues summary and submission

ElectraNet noted the possibility that favourable test conditions may not occur for an extended period of time, and creating desired conditions may be prohibitively expensive. It suggested in these cases that active monitoring and waiting for organic occurrence of system events would be a more cost-effective method of inter-network testing.

4.8.2. AEMO's assessment

AEMO agrees that active monitoring is an important aspect of any test program, and that useful information can be obtained from power system events that may occur during the test period.

4.8.3. AEMO's conclusion

AEMO has updated section 7.3 of the Guidelines to refer to passive testing methods, and notes potential benefits of reviewing power system performance following events which naturally occur during the course of testing.

4.9. Testing delays impacting release of transfer capacity

4.9.1. Issues summary and submission

ElectraNet made a general statement that testing delays impacting on the planned release of power transfer capacity should be avoided insofar as possible.

4.9.2. AEMO's assessment

The objective of inter-network testing is to enable new capacity to be successfully commissioned and made available to the market in a timely manner – the testing process helps demonstrate satisfactory operation of the power system for new operating conditions, mitigating potential risks that would otherwise arise if new capacity was not released in a controlled manner. AEMO agrees that delays to the release of new capacity are undesirable, and considers this should be addressed through the test program including consideration of the timing of tests (for example, time of year), test methodology, and procurement/utilisation of test facilitation services.

4.9.3. AEMO's conclusion

AEMO considers the Guidelines adequately address this concern, and this should be considered in detail when developing project specific test plans. No further changes were made to the draft Guidelines.

4.10. Minor clarifications and suggested wording changes

4.10.1. Issues summary and submission

As part of ElectraNet's submission, other comments were included alongside a table of suggestions/edits to the Guidelines. AEMO has implemented the suggested changes in the majority of these areas, and these minor changes can be seen in the change marked copy of the Guidelines included with this Final Report. Of these, AEMO considered the following warrant some further discussion, as outlined below.

- ElectraNet pointed out that the maintenance of sufficient dynamic reactive reserves is crucial for critical parts of the test process and should be explicitly acknowledged in this Guideline.
- ElectraNet noted that it is preferable to avoid tripping of generators and loads for the purpose of system testing.

- ElectraNet recommended that monitoring quantities be explicitly spelt out in the Guidelines to ensure a minimum standard of fault recorders and measurements are achieved by TNSPs and proponents.

In addition, during AEMO's review of the Guidelines it was identified that the wording in section 4.2 of the Guidelines suggests that all ISP projects will have a MINI and must therefore follow the 5.7.7 process. This is not necessarily the case, as ISP projects inside a TNSPs network may not actually have a MINI.

4.10.2. AEMO's assessment

AEMO agrees that maintenance of dynamic reserves during testing can be a critical consideration in key parts of the power system. AEMO believes that these kinds of operational restrictions or system limitations should be identified by project Proponent(s) and reflected in the test plan.

AEMO considers that appropriate tests for each project will depend upon a range of factors including the extent of any material impacts on the TNSP's network(s), and the nature of upgrades and capacity increase, as outlined in section 4.1 of the Guidelines. AEMO also considers that there may be benefits applying large perturbations to give confidence in the operation of the power system at new operating points, as doing so under controlled test conditions has benefits compared to the potential consequences of unforeseen events occurring which have the potential to result in disruptions to the power system and electricity users. These factors should be taken into consideration by the Proponent and project SISC when developing and consulting on the test program with Jurisdictional Planning Representatives under 5.7.7(f) and 5.7.7(o), and Registered Participants under 5.7.7(p).

AEMO believes the Guidelines outline the main options for testing and provides a useful framework for assessing risks associated with inter-network testing (see Appendix G), and believes the Guidelines should avoid stating a preference for particular test methods.

Defining the monitoring quantities and minimum standards for fault recorders is outside of the scope of these Guidelines. Monitoring quantities and fault recorder standards may depend upon the type of phenomena being monitored, and the nature of meters (existing, or new temporary/permanent monitoring devices) as well as site-specific CT/VT accuracy requirements, and this should be defined in the Proponent's test plan.

4.10.3. AEMO's conclusion

To address ElectraNet's feedback on maintenance of dynamic reserves during testing, AEMO has noted in section 7.1 of the Guidelines the test plan should take into account power system limitations.

AEMO is satisfied that the final Guidelines, as updated, describe the main options for testing and believes the Guidelines should not state a preference for particular testing methods.

As stated above, defining specific monitoring quantities and fault recorder standards is outside the scope of these Guidelines. Therefore, AEMO has not amended the Guidelines to include these additional requirements.

Finally, AEMO has updated the wording in section 4.2 of the Guidelines to make clear that ISP projects should be assessed as to whether they have a MINI.

5. FINAL DETERMINATION

Having considered the matters raised in submissions, AEMO's Final Determination is to replace the existing 2008 Inter-Network Test Initiation Guidelines with the Inter-Network Test Guidelines published with this Final Determination.