INTER-NETWORK TEST GUIDELINES

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1. INTRODUCTION

1.1. Purpose and scope

These Inter-Network Test Guidelines (**Guidelines**) incorporate the guidelines for determining when an *inter-network test* may be required under clause 5.7.7(k) of the National Electricity Rules (**NER**), and additional guidance, requirements and processes for the assessment and conduct of *inter-network tests*.

The NER and the National Electricity Law prevail over these Guidelines to the extent of any inconsistency.

1.2. Definitions and interpretation

1.2.1. Glossary

Terms defined in the National Electricity Law and the NER have the same meanings in these Guidelines unless otherwise specified in this clause.

Terms defined in the NER are intended to be identified in these Guidelines by italicising them, but failure to italicise a defined term does not affect its meaning.

In addition, the words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Guidelines.

Term	Definition
AC	Alternating current
AEMO	Australian Energy Market Operator Limited
Affected TNSP(s)	A TNSP whose *transmission system* is impacted by a Project as assessed against the MINI criteria
DC, HVDC	Direct current, high voltage direct current
EJPC	The Executive Joint Planning Committee is the executive committee the JPC reports to
INTRC	The Inter-network Test Reference Committee, established to provide oversight of all Project SISCs and promote consistency across Projects that have a *material inter-network impact*. The committee reports to the EJPC (and NEMOC as appropriate).
ISP	The Integrated System Plan, a whole-of-system plan that provides an integrated roadmap for the efficient development of the National Electricity Market (NEM) over the next 20 years and beyond, published by AEMO under rule 5.22 of the NER[1].
JPC	The Joint Planning Committee, a NEM committee that supports effective collaboration, consultation and coordination between Jurisdictional Planning Bodies, TNSPs and AEMO (as the national transmission planner) on electricity transmission network planning issues. Key responsibilities of the JPC include: • Coordinate long-term energy security and reliability across the NEM through integrated multi-regional planning of the national transmission network. • Collaborate and coordinate joint planning projects between regions. • Provide visibility and discuss root causes of NEM critical events, and how an integrated planning approach can protect against such events.
MINI	*Material inter-network impact* as defined in the NER and the MINI criteria (see Related Documents below).

[1] The latest ISP can be found here - https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp

Term	Definition
MINI criteria	The criteria *published* under NER rule 5.21 for assessing whether a proposed *transmission network augmentation* is reasonably likely to have a *material inter-network impact*.
NEM	National Electricity Market
NEMOC	National Electricity Market Operations Committee
NER	National Electricity Rules (as amended from time to time)
PSMRG	The Power System Model Reference Group is an existing technical expert reference group which focuses on power system modelling and analysis techniques to ensure an accurate power system model is maintained for power system planning and operational analysis. Some of the group's key relevant objectives include: • Provide a consistent basis for the modelling of the NEM interconnected system. • Establish procedures and methodologies for power system analysis.
Power System Stabiliser	*Power system* stabilising equipment associated with *generating plant* (including energy storage systems), or power oscillation dampers associated with *synchronous condensers*, STATCOMs and SVCs.
Project	Any *power system* development or activity of a kind described in chart 1 of NER clause 5.7.7(a) which could have a *material inter-network impact*, including, for example, new *transmission lines*, *generating system connections* or , *control system* changes. For convenience, chart 1 is reproduced in Appendix A of these Guidelines.
Relevant executives	Executives from the organisations that are represented on a Project's SISC
SISC	System Integration Steering Committee
STATCOM	Static synchronous compensator
SVC	*Static VAR compensator*
TNSP	*Transmission Network Service Provider*

1.2.2. Interpretation

These Guidelines are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.

1.3. Related documents

Title	Location
Criteria for Assessing Material Inter-Network Impact of Transmission Augmentations (MINI criteria)	https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/transmission-and-distribution-in-the-nem/stage-3-application[2]
Power System Model Guidelines (and associated modelling requirements including data sheets)	https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/modelling-requirements

[2] Under Related guides and policies

2. APPLICATION AND STRUCTURE

2.1. NER requirements

(a) Sections 3.2 to 6 of these Guidelines and related Appendices comprise the guidelines made under NER clause 5.7.7(k), to assist *Registered Participants* to determine when an *inter-network test* may be required in respect of a Project.

(b) Sections 4 to 6 are to be considered by AEMO or the *Relevant TNSP* (as applicable) in determining whether an *inter-network test* is required or before giving notice to a *Proponent* requiring an *inter-network test* under NER clause 5.7.7(g).

2.2. Additional guidelines

(a) Section 3 of these Guidelines and associated Appendices provide an overview of the roles and responsibilities of AEMO, affected *Registered Participants* and jurisdictional representatives in the assessment and, if required, testing process.

(b) Section 3 also sets out a recommended governance framework to manage and coordinate the activities necessary to achieve successful *inter-network testing*, including interaction with consultative bodies or working groups and committee oversight.

(c) Sections 7 to 10 of these Guidelines and associated Appendices include more detailed guidelines for the conduct of *inter-network tests*, including pre- and post-test requirements.

3. GOVERNANCE, ROLES AND RESPONSIBILITIES

3.1. Roles and responsibilities across clause 5.7.7 processes

Table 1 summarises the roles and responsibilities of AEMO, *Proponents*, *Relevant TNSPs* and other bodies across the processes contemplated by NER clause 5.7.7 – from determining whether an *inter-network test* is required in relation to a Project, to preparing for, coordinating and conducting the tests and results analysis.

Appendix B provides an overview of the regulatory process flow and timeframes associated with the clause 5.7.7 process.

Table 1 Roles and responsibilities in relation to clause 5.7.7 processes

Entity	Role	Responsibilities
AEMO	Oversight and governance of 5.7.7 process, coordination of 5.7.7 tests	• Assess Project requirements for 5.7.7 testing based on MINI criteria (for items 5 and 6 as shown in Appendix A) • Receive request for testing as per 5.7.7(e) • Provide notice of testing to *Relevant TNSPs* and Jurisdictional Planning Representatives • Accept testing plan • Conduct testing in conjunction with *Relevant TNSPs* and *Proponent*. • Appoint an *inter-network test* officer to coordinate actual tests. • Approve increases to transfer capacity as part of the testing process.

Entity	Role	Responsibilities
Inter-network Test Reference Committee (INTRC)	Assist project SISCs, the EJPC and JPRs with fulfilling their obligations under clause 5.7.7	• Develop consensus amongst the INTRC and Jurisdictional Planning Representatives (JPR) to fulfil the JPR's role under NER 5.7.7. • Identify and track key strategic issues including high-level reporting to the EJPC and NEMOC. • Promote collaboration between Network Service Providers (NSPs). • Support implementation of the 5.7.7 process, including: – Promote consistency and support the relevant project System Integration Steering Committees (SISC) in the review of test procedures. – Provide guidance to the AEMO nominated coordinator of an inter-network test in respect of their functions. – Support the review of relevant guidelines. – Agree and document decisions on when to undertake or not undertake inter-network tests. • Support project SISCs with development of stakeholder messaging.
Executive Joint Planning Committee (EJPC)	Review and approval	• Nominate JPC members to join the INTRC, along with relevant planning, connections and operational personnel. • Receive updates from the INTRC, SISC, *Relevant TNSPs* and provide oversight and guidance as required.
Jurisdictional Planning representative (JPR)	Assessment of 5.7.7 test program	• Support review of test programs and provide any proposed changes and recommendations to AEMO in accordance with clause 5.7.7.
Proponent	Overall Coordination of 5.7.7 testing for the Project	• Coordinate *Relevant TNSPs* and other *Registered Participants* as required to perform system studies and modelling to design and confirm 5.7.7 testing requirements • Prepare a draft *test program* (5.7.7(m)). Procure *inter-network test* facilitation services as required for testing (5.7.7(u))
Relevant TNSP	Assessment of Project against MINI criteria and Coordination with *Proponent* to enable 5.7.7 testing of Project	• Assess Project requirements for 5.7.7 testing based on MINI criteria • Confirm with *Proponent* requirements for 5.7.7 testing • A *Relevant TNSP* may also notify the *Proponent* that 5.7.7 testing is required (5.7.7(g)) • Establish the Project SISC ensuring it is appropriate for the size and complexity of the Project • Work together with the *Proponent* to complete system studies and establish 5.7.7 testing requirements
System Integration Steering Committee (SISC) – see section 3.2	Ensure collaboration across AEMO and TNSP's to allow Projects to be integrated into the NEM	The SISC members will be responsible for: • Establishing a Terms of Reference for the SISC including governance and reporting, which may require approval by relevant executives. • Developing a timetable and schedule for the delivery of all testing and market integration activities. • Coordinating NEM integration studies (including assessment of power system limits and identifying requirements for Special Protection Schemes). • Developing and consulting on *inter-network test* programs. • Coordinating communications to external parties on progress and delivery of the interconnector transfer capability.

3.2. Governance framework for inter-network testing – the SISC

3.2.1. Establishing a Project SISC

(a) An *inter-network test* is usually a major undertaking, requiring significant resources from all impacted parties, so it is important that the testing is completed in a safe and timely manner, working within agreed timeframes. To coordinate and oversee these requirements, a SISC should be established for each Project once it is determined that it requires *inter-network tests*.

(b) The workstream structure and number of representatives included in a Project's SISC should be suitable for the size and complexity of the Project. It is envisaged that a SISC will include at least one representative of the *Proponent*, the *Relevant TNSP* and AEMO. The SISC may also include representation from any Affected TNSP(s) or Jurisdictional Planning Representatives (if appropriate). Once established the SISC will meet regularly to ensure the requirements of the 5.7.7 process are met.

3.2.2. SISC activities

(a) The SISC will conduct the activities required to demonstrate the capability of a Project to the SISC's satisfaction, in each of the workstreams shown in Figure 1. This workstream structure is shown as a guide only and to demonstrate the key functions that need to be carried out for Projects that require an *inter-network test*.

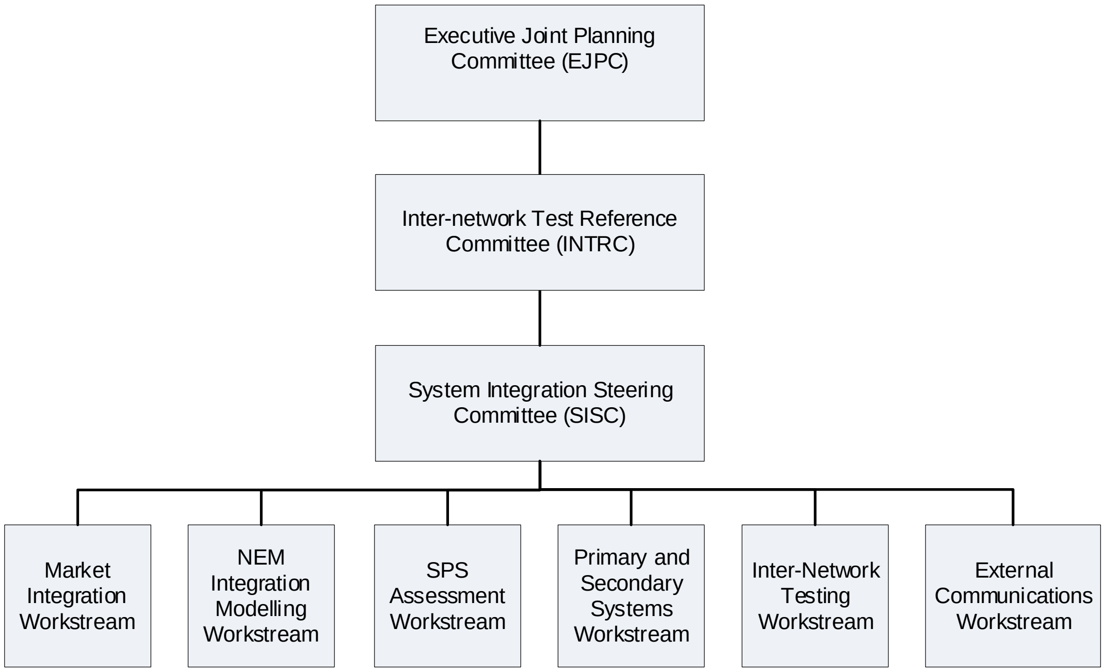
(b) The SISC may determine whether workstreams should be combined or divided, and will determine the allocation of tasks between its members. Taking account of the nature and complexity of the Project, the SISC can define an alternative workstream structure when establishing its Terms of Reference, which may require approval by relevant executives.

(c) The SISC or relevant workstreams may consult with relevant NEM groups such as the Power System Modelling Reference Group (PSMRG), Operational Planning Working Group (OPWG) and Power System Security Working Group (PSSWG). Consultation is normally expected to cover key matters including *network* modelling and outcomes, and the *test* program.

(d) The *Relevant TNSPs* may provide updates on Project progress to the INTRC and other groups as necessary.

(e) It is expected that each SISC would consult the INTRC, in particular regarding the proposed test program as well as decisions to undertake tests or not undertake tests.

Figure 1 SISC workstreams and reporting (in relation to 5.7.7 obligations)



The key functions of each workstream are as outlined below:

- Market Integration Workstream:
  - Facilitate market integration activities (including regional boundary location, loop flows, NEM Dispatch Engine (NEMDE), inter-regional *transmission use of system* (TUOS), Settlement Residue Auctions (SRAs).
- NEM Integration Modelling Workstream:
  - Co-ordinate NEM integration studies (including limit equation development, oscillatory stability and review).
  - This may also include *Generator* and customer impacts/adjustment of generator control settings.
- Special Protection Scheme (SPS) Assessment Workstream:
  - Co-ordinate the development of a co-ordinated SPS, including review and modification (including decommissioning) of existing SPS and of emergency control schemes.
- Primary and Secondary Systems Workstream:
  - Primary and secondary systems design input/co-ordination, including required rectification found during integration studies and detail design.
  - Point to point testing of Supervisory Control and Data Acquisition (SCADA) and protection.
- Inter-network testing Workstream:
  - Inter-network testing to facilitate timely release of full augmentation capacity.
- External Communications Workstream:
  - External communications to be managed in conjunction with Relevant TNSP and Project directors.
  - The External Communications Workstream is also expected to include government relations and stakeholder communications relating to the impact of tests, timing of capacity release and considerations relevant to existing and new connections. In some instances, a separate connections workstream may be necessary.

4. PROCESS TO DETERMINE WHETHER INTER-NETWORK TESTING IS REQUIRED

This section 4 describes the process to assess whether an *inter-network test* is required for a Project.

4.1. Project classification

For the purpose of these Guidelines, Projects may be classified according to the categories shown in Table 2.

Table 2 Project classifications

Category	Project classification	Type of Project
A	New AC or DC *interconnector*, generally developed jointly by multiple *Proponents*	• New AC *interconnector* between *regions* which are already synchronised with an existing *interconnector*. • New DC *interconnector* between two *regions* (which may or may not already be *interconnected* synchronously or asynchronously).
B	Upgrade to an existing AC or DC *interconnector* affecting two or more TNSPs, usually planned by two or more *Proponents* and involving augmentation in multiple *regions*. The purpose or effect of the Project is to increase the *transfer capability* of an existing *interconnector*, resulting in a **MINI**.	Projects in this category would typically be: • Thermal upgrades • Changes to control schemes • Battery systems providing grid functions to increase *interconnector* capacity. • SVCs to increase *interconnector* limits • DC converter station upgrades
C	Changes to *generation* or a *network* within a single *region* that impacts the *transfer capability* of an existing *interconnector*, resulting in a **MINI**. Note that where such work can cause a reduction to the interconnector limit it may also trigger the **MINI**, then testing may be required under 5.7.7(k).	Projects in this category would typically be: • Thermal upgrades • New automated control schemes • Changes to existing control schemes • New *generating systems* • New *synchronous condensers* • SVCs • STATCOMs • *Emergency frequency control schemes* and emergency controls
D	Substantial changes to control systems or stabilisers.	Projects in this category would typically be: • New installations of systems and equipment • Major upgrades of systems and equipment • Significant setting changes within existing systems or equipment • *Emergency frequency control schemes* and emergency controls

4.2. Assess Project against MINI criteria

(a) The *Relevant TNSP(s)* for the Project (or *AEMO* for items 5 and 6 in chart 1 of Rule 5.7.7) (reproduced for convenience in Appendix A) should complete *network* modelling. This *network* modelling should be sufficiently detailed to determine whether the Project exceeds any of the MINI criteria (as detailed in section 5 and section 6 of these Guidelines)[3].

[3] See https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/transmission-and-distribution-in-the-nem/stage-3-application, under Related guides and policies

(b) If the Project does not exceed any MINI criteria, the *Relevant TNSP(s)* or AEMO must determine that an *inter-network test* is not required, and the remainder of NER clause 5.7.7 does not apply.

(c) By virtue of their size and impact on the *power system*, all *actionable Integrated System Plan (ISP) projects*[4] should be assessed as to whether they have a MINI.

4.3. Assess the requirement for inter-network testing under clause 5.7.7

(a) If a Project is identified as having a MINI, the *Relevant TNSP(s)* (in consultation with AEMO) must then determine whether *inter-network testing* is required under NER clause 5.7.7. A non-exhaustive list of items to consider when assessing the requirement and necessity for *inter-network testing* is outlined below:

 (i) What tests would be appropriate to validate models and prove new equipment operation?

 (ii) Are special *network* conditions required for the testing?

 (iii) Can suitable testing be carried out under alternative NER clauses? To confirm, testing should not be conducted under NER clause 5.7.7 if the same purpose can reasonably be achieved by testing under any other NER provisions.

 (iv) Will the Project have a material impact on *power system* assets or operation? (For example, one or more MINI criteria may be exceeded, but the Affected TNSPs and AEMO may agree there is no material impact on the *power system*.)

 (v) Are there any other surrounding circumstances that impact the decision to carry out *inter-network tests*?

 (vi) Does the testing required constitute an *inter-network test*? Classification of a test as an *inter-network test* may be indicated if a preliminary assessment of the methodology for conduct of the test indicates a need to consider at least one of:

  (A) The application and/or removal of special purpose power transfer constraints that will affect *dispatch*.

  (B) A variation of the *central dispatch* outcome in a manner that is not otherwise permitted by the NER.

  (C) A requirement for procurement of test facilitation services, as provided under clause 5.7.7(u).

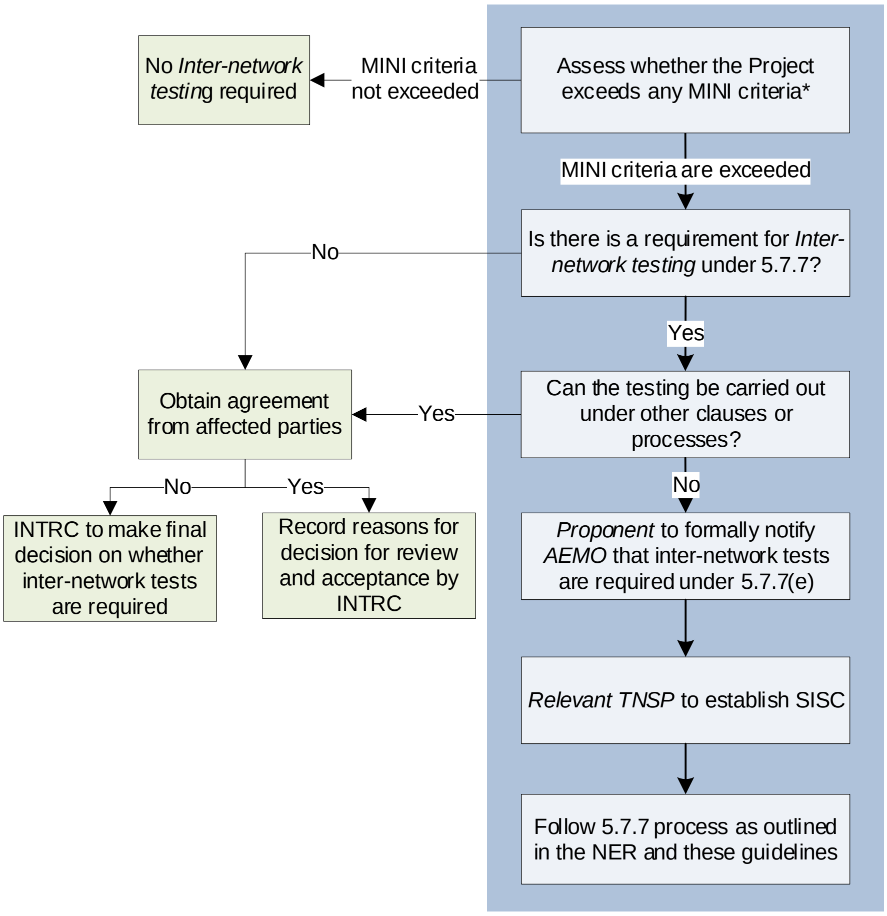
  (D) The changing of a plant operating condition in a manner that is not otherwise permitted, and that may affect the *market*.

  (E) A requirement for a Registered Participant to incur a cost through its participation in the *inter-network test*.

(b) A flowchart of the process for assessing whether a Project listed in items 1 to 4 in Appendix A requires an *inter-network test* is shown in Figure 2 below.

[4] See ISP Rules at NER 5.22

Figure 2 Assessment of whether inter-network test is required – activities 1 to 4 (see Appendix A)



* By virtue of their size and impact on the *power system*, *all* actionable ISP Projects should be assessed as to whether they have a MINI.

4.4. Documentation and communication of determination

(a) If, after following the process described in this section, the *Relevant TNSP(s)* or AEMO conclude that an *inter-network test* is not required for a Project:

(i) the *Relevant TNSP(s)* or AEMO must document this decision (see Appendix C for details on what information should be documented);

(ii) the INTRC must review this recommendation and either approve or not approve it;

(iii) If any one of the *Relevant TNSP(s)*, AEMO or the *Proponent* considers that an *inter-network test* is required then AEMO must refer the Project to the INTRC to decide whether or not an *inter-network test* is required under NER clause 5.7.7, consulting with the EJPC as required.

(b) If the INTRC does not approve a recommendation under paragraph (a)(ii), the *Relevant TNSP* (or *AEMO* as appropriate) must notify the Proponent in accordance with NER clause 5.7.7(g) that an *inter-network test* is required.

5. MATERIAL INTER-NETWORK IMPACT

5.1. Assessment requirement and definition

(a) It is a requirement of clause 5.7.7 for the *Relevant TNSP* (and/or AEMO) to determine whether a development will trigger the need for an *inter-network test*. The first task in assessing if a test may be required is to assess whether the Project will have a MINI.

(b) *Material inter-network impact* is defined in the Chapter 10 of the NER as:

> "A material impact on another *Transmission Network Service Provider's network*, which impact may include (without limitation):
> (a) the imposition of *power transfer constraints* within another *Transmission Network Service Provider's network*; or
> (b) an adverse impact on the quality of *supply* in another *Transmission Network Service Provider's network*."

(c) This is a broad definition, but it is not exhaustive because the impacts listed under paragraphs (a) and (b) of the definition apply "without limitation". It could, therefore, extend to other impacts on another TNSPs *network* that are reasonably considered to be material.

5.2. Planning expectations

Prior to the clause 5.7.7 process, it is assumed that all affected parties in relation to a Project will have complied with their responsibilities under NER clauses 5.14.3 (Joint planning obligations of TNSPs) and 5.14.4 (Joint planning obligations by TNSPs and AEMO). It is anticipated that any associated discussions will be shared as a Project moves into the clause 5.7.7 process, which will assist in determining whether the Project is likely to have a MINI.

5.3. Material inter-network impact assessment method

(a) The MINI criteria should be applied to a Project to assess whether it is reasonably likely to have a MINI.

(b) Assessments against the MINI criteria should use the best available models and take into account the equipment in service on the *power system* that is reasonably expected to exist by the time the Project is completed and brought into service, including developments committed at the time of the assessment being made.

(c) In the context of inverter-based resource (IBR) *connections* across the NEM, *control system* interactions considered and assessed, which may impact one or more MINI criteria.

(d) A MINI is determined by:

(i) Comparing the augmented case with an unaugmented (base) case.

(ii) Ensuring the augmented case conditions are as near as possible to the base case, while adjusting the demand and/or *generation dispatch* conditions to define the new *network* capabilities and *dispatch* scenarios.

(iii) Carrying out contingency studies over a reasonable range of base cases (i.e. various assumptions about *load*, *generation dispatch* and *network* topology conditions).

(e) A list of examples of Projects including application of the MINI criteria is provided in Appendix D.

5.4. Cumulative application of MINI criteria

(a) If a Project consists of a number of stages under a Regulatory Investment Test for Transmission (RIT-T) or other approval process that, individually do not exceed the MINI criteria thresholds but cumulatively do, then the Project overall is considered to have a MINI. This will be assessed on a case-by-case basis.

(b) Where several Projects that individually or collectively have a MINI are likely to undergo *inter-network tests* in similar timeframes, AEMO and the relevant SISC(s) will work together, consulting the INTRC as needed to determine the most appropriate manner of conducting and staging the necessary tests, giving due consideration to the cumulative impacts and timing of *inter-network tests*, and opportunities to implement efficient processes taking these factors into account. In these circumstances AEMO may require additional testing to be undertaken in consultation with the affected *Proponent* and Relevant TNSPs. AEMO will also give due consideration to the timing and phasing of testing to ensure overall *power system security* and stability.

6. NETWORK MODELLING

Network modelling is a critical factor in the assessment of a Project's impact and its successful implementation. This section addresses the issues surrounding *network* modelling.

6.1. Modelling requirements generally

(a) The NER requires *Network Service Providers* to provide encrypted and unencrypted models for dynamic plant to AEMO in accordance with the *Power System Model Guidelines*. Computer modelling is the only tool(s) which allow an assessment of a new Project's impact on the *power system* to be made prior to construction and commissioning of the Project.

(b) Power system modelling is a complex process and requires significant resource commitments from *Proponent*(s). It should be noted that upgrades to existing *interconnectors* that are being achieved using new types of equipment and techniques may require significant modelling to ensure no unintended consequences occur on the *power system* when the equipment is placed into service.

(c) Computer modelling shall be undertaken in appropriate modelling program(s) capable of assessing relevant phenomena. All computer models that are to be relied upon for determining *inter-network test* requirements, pre-test simulations and for post-test analysis must meet the following criteria:

  (i) The *network* is to be modelled in the anticipated configuration at the time of the test (to include all committed projects, anticipated *generation* changes etc.) for relevant study years.

  (ii) All *network* models and modelling data should conform to NER clause 5.2.3(d)(8), which requires NSPs to maintain accurate models for planning and operational purposes. If necessary, these should include modelling of the appropriate *distribution* sub-networks.

  (iii) All modelling results should provide suitable output charts, diagrams, visual outputs etc to allow satisfactory assessment of results.

(d) Once it is identified that a Project requires an *inter-network test* and the SISC is established, the software package(s) used should be agreed by the NEM integration modelling workstream, in consultation with the SISC and relevant groups as required. When selecting software package(s) for modelling, the SISC should consider the *Power System Model Guidelines*.

(e) Where Projects involve the installation of new systems and equipment, new computer models will be required. These models will need to be assessed as suitable for *power system* modelling purposes through quality validation with the manufacturer of the equipment or the designer of the system (in accordance with the *Power System Model Guidelines*). This may involve testing and validation of individual *plant* prior to commencement of *inter-network tests*.

(f) Equipment and model performance may also be assessed using Real Time Simulation (RTS) techniques for complex equipment such as HVDC links, STATCOMs, Smartwires™, SVCs, and battery controls. RTS results may require hardware in the loop testing to confirm hardware outputs against modelled outputs. This however does not avoid the requirement to provide computer models as described above.

6.2. Process requirements

(a) Appendix E provides an illustration of the model development process during delivery of the Project.

(b) The SISC, under its NEM integration modelling workstream as shown in Figure 1, identifies the modelling requirements for the Project as outlined in Appendix F. These requirements are to be approved by the SISC.

(c) The timeframe for *network* modelling should be provided and monitored by the *Proponent* of the Project. The *Proponent* should also assess model requirements and determine what input is required from other NSPs to support development of required models.

7. CREATION OF TEST PROGRAM

7.1. General principles

Once the *Relevant TNSP* (or AEMO) informs the *Proponent* that an *inter-network test* under 5.7.7 is required, the *Proponent* must create a draft *test program*. The *test program* should be created in consultation with AEMO, which is expected to occur via the SISC. The *test program* should be created based on the following general principles:

(a) The primary purpose of testing is to verify and give confidence in the magnitude and impacts of the change in *power transfer capability* of (and between) more than one *transmission network* associated with a Project, and to verify model information used to determine *power system* limits and undertake various planning and operational studies.

(b) Because of the potential for unmodelled interactions between control schemes, sufficient testing should be planned to give confidence that no such interactions are likely to occur. It may be prudent to include system monitoring at lower power flows for a period of time with the commissioned plant in the *test program* to allow for any control interactions to be identified, prior to increasing transfer capacity.

(c) Any *network* testing carries a level of intrinsic risk which must be assessed and appropriately mitigated. Irrespective of the level of confidence in *power system* models used for determining system limits, they can never reasonably cover all possible characteristics that could impact *power system* performance. Therefore, the *test program* should be staged in appropriate increments and provide confidence in *power system* models and performance.

(d) The *test program* should be developed taking into account *power system* operational limitations, for example reactive reserve requirements.

(e) Suggestions for an *inter-network testing* risk assessment approach are provided in Appendix G.

(f) The final testing methodology (including staging of tests and hold points) included in the *test program* will be determined by the SISC, and through consultation under NER clause 5.7.7.

7.2. Pre-testing requirements

The *test program* must outline the pre-testing requirements for any equipment which forms part of the *inter-network test*. The following principles should be followed when defining these requirements:

(a) It is a pre-requisite for an *inter-network test* that all individual equipment items associated with the Project must be satisfactorily tested by the *Proponent* in accordance with normal commissioning procedures for new or modified equipment under NER clause 5.8.4. Completion of these tests and satisfactory results are a pre-requisite for commencing an *inter-network test*. Satisfactory documentation to demonstrate commissioning of individual *plant* includes but is not limited to:

   (i) signed commissioning certificates from the *Proponent* for equipment, e.g. switching equipment and protection and control systems;

   (ii) commissioning test measured results showing satisfactory operation of equipment and control loops to the intended design; and

   (iii) reports and similar documentation which is produced from time to time during commissioning of electrical *plant* and equipment, which and would reasonably be expected required to be produced during commissioning of equipment such as SVCs, STATCOMs, control systems, *emergency frequency control schemes* and emergency controls, communications systems, etc. onto the *power system*.

(b) Depending on the test method, temporary changes to protection settings/functions may be required to safely facilitate an *inter-network test*. These requirements must be clearly defined in the *test program*.

(c) Agreement by the SISC on pre-testing requirements may enable the scope of the *inter-network test* requirements to be reduced, depending on a number of factors. Important pre-test items which may impact *inter-network test* requirements include for example voltage set point step tests for SVCs or basic control loop testing. However, it is envisaged that equipment such as SVC power oscillation dampers or series capacitors would not normally be enabled prior to *inter-network testing* due to the potential MINI which could arise even at existing *interconnector power transfer* levels.

7.3. Power system disturbance methods and monitoring

(a) In performing an *inter-network test*, the *power system* may be required to be disturbed from its steady state position to enable dynamic responses from control loops and other associated systems to be tested.

(b) Appropriate methods for disturbing the system include:

   (i) tripping loads or generating units;

   (ii) tripping *reactive plant* such as capacitor banks and reactors;

   (iii) tripping (switching) *transmission lines*; and

   (iv) injecting *active power* and *reactive power*.

(c) In some cases, application of larger perturbations may be considered, such as application of faults. There may also be benefit reviewing performance following power system events that may occur during the course of *inter-network testing*. The final *power system* disturbance methods used will be determined by the SISC and through consultation under clause 5.7.7.

(d) The *test program* must outline the *power system* disturbance and/or "passive" testing methods to be used as part of the *inter-network testing*.

(e) In order to monitor the *power system* during operation and in response to the disturbance methods the *test program* should outline the appropriate monitoring required to assess the performance of the *power system* in response to the test and through normal operation of the *power system*. In addition, the *test program* should define how long monitoring equipment should remain connected to the *power system* to monitor the behaviour of the new augmentation, and the wider *network* to check for unanticipated responses (e.g. undamped oscillations etc.). The *test program* should also specify the system conditions required to complete this monitoring (if specific system conditions are required).

7.4. Power system conditions for testing

Onerous *power system* conditions may be experienced at any time of year; as such, testing during summer (or winter) peak conditions and/or during periods of low *synchronous generation* or low system fault levels should be considered. Part of the remit of the NEM integration modelling workstream is to establish what these conditions are prior to planning any test activities, taking into account operational variations. This information should be accounted for when developing the *test program* to ensure that a suitable range of *power system* conditions are identified.

7.5. Additional requirements for AC parallel and DC interconnectors

(a) The testing of AC parallel *interconnectors* should consider the following:

(i) Since there will be other connections to the *network*, testing may be able to be carried out at higher levels of transfer since the loss of infeed following an *interconnector* trip will be carried by the other *interconnector*. (Note that this will require a level of balancing with other *interconnectors* to ensure power system limits are not exceeded during testing.)

(ii) If there is a possibility that the *network* might, under foreseeable circumstances, be operated on just the new *interconnector* (i.e. the existing *interconnector* out of service), consideration should be given to testing this mode of operation (i.e. as a new radial interconnection).

(b) The testing of DC *interconnectors* should consider the following:

(i) Testing should include tests during periods of low fault level since this is a DC *interconnectors* most vulnerable period of operation.

(ii) Tests should commence with the tripping of the DC *interconnector* at different load levels to confirm the operation of any ancillary service designed to contain frequency deviations. Once this has proved satisfactory at full transfer, the next stages can be conducted.

(iii) The testing should be extended to AC lines feeding into the convertor substation (usually just by tripping/reclosing) to confirm changes to voltage angle/voltage magnitude/system strength.

(iv) As a DC *interconnector* has the ability to control voltage or reactive capability at the point of common coupling, a series of voltage step test as well as reactive power injection tests are required for relevant control modes.

(v) Where the DC *interconnector* is expected to provide frequency control to the *power system*, frequency control tests are required.

(c) Additional tests for any *interconnectors* may be required as part of plant commissioning and NSP approval processes.

8. ACHIEVING NETWORK CONDITIONS REQUIRED FOR TESTING

(a) The *test program* will detail the *network conditions* required for the *inter-network tests.* As *network* conditions change, system transfers also change meaning that it will not always be possible to achieve the desired conditions for the required duration of the proposed test.

(b) Depending on the conditions required, it is an option to wait until conditions change and the desired transfer is likely to be achieved for the test duration. This could have a significant impact on the timeframe required to complete the test process, and resource costs and logistics.

(c) An alternative option is for the *Proponent* to arrange test facilitation services as contemplated in NER clause 5.7.7(u), which could include:

(i) out-of-merit *generation dispatch*;

(ii) *generating unit* tripping;

(iii) *active power* or *reactive power* injection; or

(iv) *voltage* step-testing.

(d) During *inter-network tests* that require out of merit order *dispatch*, there is a possibility of additional *settlements residues* arising in the *market*. In accordance with NER clause 5.7.7(r)(2), testing should be designed to minimise variation from the *central dispatch* outcomes that would otherwise occur, and the *Proponent* must have an agreement with AEMO to cover potential *settlement residues* (as required by clause 5.7.7(aa).

9. TESTING

(a) *Inter-network tests* will be carried out as detailed in the *test program* under the control of the Test Coordinator who is nominated by AEMO under NER 5.7.7(ad) and is responsible for testing and is empowered to vary the test processes in accordance with agreed guidelines.

(b) At each test hold point (as defined in the *test program)* data gathered from any monitoring equipment will be reviewed to confirm satisfactory performance of the test. Once this review is completed, the testing can proceed to the next hold point.

(c) Provided all tests are satisfactorily completed in line with the *test program*, the testing process can be concluded.

10. POST-TEST REPORTING REQUIREMENTS

(a) The *Proponent* must report on test results and observations at the completion of each hold point and at the conclusion of an *inter-network test*, and provide that report to AEMO and each Affected TNSP prior to the confirmation of new *network* limits and their approval for service by AEMO.

(b) 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*; and

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

(c) As an outcome of testing, validated *network* and dynamic data should be provided to AEMO for integration into operational systems.

APPENDIX A. IDENTIFICATION OF PROPONENT AND RELEVANT TNSP FOR EACH PROJECT[5]

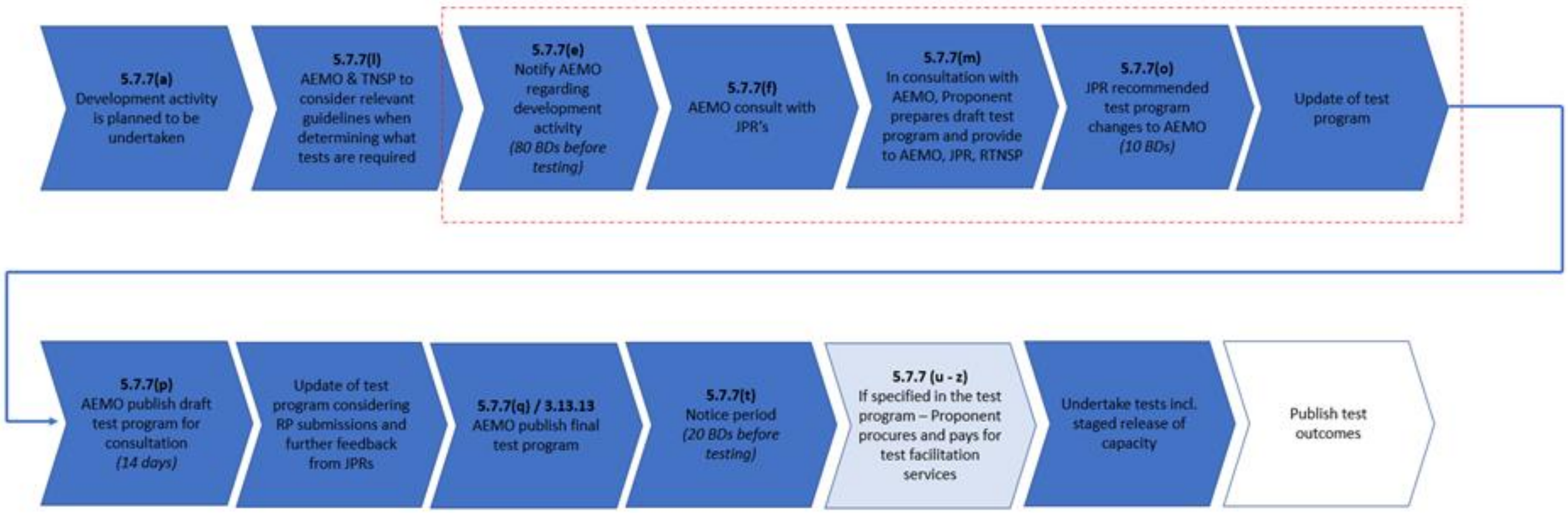
No.	Kind of development or activity	Proponent	Relevant TNSP
	column 1	**column 2**	**column 3**
1.	A new *transmission line* between two *networks*, or within a *transmission network*, that is anticipated to have a *material inter-network impact* is commissioned.	*Network Service Provider* in respect of the new *transmission line*.	*Proponent* and the *Transmission Network Service Provider* in respect of any *network* to which the *transmission line* is *connected*.
2.	An existing *transmission line* between two *networks*, or within a *transmission network*, that is anticipated to have a *material inter-network impact* is *augmented* or substantially modified.	*Network Service Provider* in respect of the *augmentation* or modification of the *transmission line*.	*Proponent* and the *Transmission Network Service Provider* in respect of any *network* to which the *transmission line* is *connected*.
3.	A new *generating unit* or *facility* of a *Customer* or a *network* development is commissioned that is anticipated to have a *material inter-network impact*.	*Generator* in respect of the *generating unit* and associated *connection assets*. *Customer* in respect of the *facility* and associated *connection assets*. *Network Service Provider* in respect of the relevant *network*.	*Transmission Network Service Provider* in respect of any *network* to which the *generating unit*, *facility* or *network* development is *connected* and, if a *network* development, then also the *Proponent*.
4.	Setting changes are made to any *power system* stabilisers as a result of a *generating unit*, *facility* of a *Customer* or *network* development being commissioned, modified or replaced.	*Generator* in respect of the *generating unit*. *Customer* in respect of the *facility*. *Network Service Provider* in respect of the relevant *network*.	*Transmission Network Service Provider* in respect of any *transmission network* to which the *generating unit*, *facility* or *network* development is *connected*.
5.	Setting changes are made to any *power system* stabilisers as a result of a decision by *AEMO*, which are not covered by item 4 in this table.	*AEMO*	None.
6.	*AEMO* determines that a test is required to verify the performance of the *power system* in light of the results of planning studies or simulations of one or more system incidents.	*AEMO*	None.

[5] See NER clause 5.7.7(a) Chart 1 for original table

APPENDIX B. 5.7.7 PROCESS DIAGRAM

The figure below outlines the 5.7.7 process and regulatory timeframes.

In order to reduce the statutory timeline for 5.7.7 testing, *Proponent*s are encouraged to commence interaction with AEMO prior to a request for testing under 5.7.7(e). This prior interaction would enable modelling and simulation results to be understood and a collaborative development of the 5.7.7 test regime with AEMO and other TNSPs (as required). This is expected to reduce the regulatory timeframes associated with *inter-network tests* in the areas illustrated with the red dashed box.



APPENDIX C. INFORMATION TO BE DOCUMENTED IF INTER-NETWORK TESTING IS NOT REQUIRED FOR ANY REASON

The *Relevant TNSP* (or AEMO for items 5 and 6 as shown in Appendix A) should detail the following information (where applicable) for review by the INTRC:

- Details of *network* modelling that has been completed to justify the decision not to test (could include the augmentation technical report, or other reports).
- Which MINI criteria are exceeded.
- Details of what tests may be carried out if *inter-network testing* were to be completed[6].
- Details of why it is not possible to carry out these *inter-network tests*.
- Why *inter-network test*ing is not required.
- Details of tests that will be carried out under other clauses or as part of commissioning.
- How the risks associated with any exceeded MINI criteria that aren't being tested are being managed.
- Confirmation of agreement from AEMO, the *Relevant TNSP*, any Affected TNSP(s) and the *proponent* not to test (as appropriate).

[6] This will assist with determining whether such tests could be undertaken through other processes.

APPENDIX D. EXAMPLES OF SCENARIOS FOR CONSIDERATION UNDER NER 5.7.7

Disclaimer: This Appendix has been prepared to provide a general understanding of the processes contained in the Guidelines. These examples should not be relied upon as being indicative of the outcomes to be expected in real-life circumstances. To the extent that there is any inconsistency between the Guidelines and this Appendix, the Guidelines prevail in all circumstances.

Below is a list of examples, which are then categorised and assessed to see if they are likely to exceed the MINI criteria (meaning that an *inter-network test* may be required). Possible *inter-network tests* are also included below to demonstrate testing that may be appropriate in each case. In practice the final testing requirements will be determined by the SISC and through consultation on the *test program*.

Example 1.

A TNSP is planning to upgrade an interconnector by re-tensioning a section of overhead line, increasing the existing thermal limit by 120 megawatts (MW), from 500 MW to 620 MW. Studies show that other limitations (e.g. voltage stability, oscillatory stability) are well in excess of the revised maximum transfer limit. There are no modifications to dynamic plant associated with this Project and no additional *control schemes* to manage *non-credible contingency events* (such as those that might be implemented under NER clause S5.1.8).

Classification (Table 2)

This Project is being undertaken within a single jurisdiction by a single TNSP, hence it falls under Category C in Table 2.

Does Project cause a MINI?

The Project raises the thermal limit by 120 MW, with no impact on other MINI criteria.

The MINI criteria is triggered when there is an increase in *power transfer capability* between *transmission networks* of more than the minimum of 3% of maximum transfer capability and 50 MW.

Since this exceeds the MINI threshold, an assessment should be undertaken regarding the requirement for *inter-network testing*.

Example inter-network testing that could be used

The benefit of undertaking *inter-network tests* would be limited to identification of any adverse impacts not identified through *power system* modelling, including operational variations in *power system* conditions. The *Proponent* should consult with *Relevant TNSPs* and AEMO to consider the most prudent approach for monitoring and release of capacity. This may involve development of a *test program* under NER clause 5.7.7 for monitoring of the *power system* and staged release of transfer capacity.

Conclusion

Without regard to the surrounding circumstances (which this example does not seek to describe), it is likely that coordination between AEMO and *Relevant TNSPs* would be required to apply the new limits in a staged approach. Consultation would be required to determine if this is best undertaken under clause 5.7.7 or other relevant processes.

Example 2.

A TNSP plans to implement a Project in three stages:

- Stage 1: The first stage involves re-tensioning of a series of low spans to raise the thermal limit of 1,200 MW by 35 MW.

- Stage 2: The second stage involves reconductoring of a section of line, which will raise the thermal limit and transient stability limits by 35 MW.
- Stage 3: The final stage relates to installation of an SVC to increase damping of system oscillations, increasing the limit by a further 50 MW.

The total increase in inter-*network* transfer capability is 120 MW. There are no changes to emergency controls or *emergency frequency control schemes* as a result of the works.

Classification (Table 2)

This Project is being undertaken within a single jurisdiction by a single TNSP, hence it falls under Category C in Table 2.

Does Project cause a MINI?

The cumulative impact is such that the MINI is triggered in relation to the impact of the augmentation on thermal and stability limits. Testing under NER clause 5.7.7 is therefore required.

Example network testing that could be used

Testing should be undertaken in a staged manner, with consecutive release of capacity. It is anticipated that all stages would involve continuous monitoring, and stages 2 and 3 may additionally involve switching of lines and/or dynamic plant.

Conclusion

Without regard to the surrounding circumstances (which this example does not seek to describe), it is likely that tests would be required under clause 5.7.7.

Example 3.

A new *interconnector* is planned between two *regions* which are already connected by a *synchronous connection* with a maximum transfer capacity of 600 MW. A number of new and modified emergency controls are required to manage credible and non-credible *contingency events*.

Classification (Table 2)

This Project is being undertaken across two *regions* and will involve two TNSPs. It is a new *connection*, hence falls under Category A in Table 2.

Does project cause a MINI?

As a new interconnection, the Project has a significant impact on *power transfer* capacity and the topology of the *power system*. It is likely that studies would identify that a number of the other MINI criteria would also be triggered. These conditions should be checked and verified by the SISC (Figure 1).

Example network testing that could be used

Testing in this instance would be required to demonstrate not only the physical characteristics of the *interconnector*, but also the performance of associated control schemes. The performance of the system and response of the automatic schemes should be thoroughly tested using the computer models as far as practical prior to undertaking any system tests.

The functionality of the control schemes should be tested and proven as part of the normal commissioning process, such as end-to-end testing to confirm scheme operating times, that schemes are functional, measurements elements within the scheme are operational and providing correct measurements, all trigger points for the scheme are operational and triggered elements are responding to trigger events.

Testing under NER clause 5.7.7 may also include manual initiation of control schemes, depending upon their control action and the potential *power system* impact.

The SISC should assess whether special *network* conditions are required for tests. Testing undertaken to validate modelled performance and give confidence in the release of capacity may include line/transformer switching, switching of dynamic plant, battery ramping, and load/generator trip tests.

Conclusion

Without regard to the surrounding circumstances (which this example does not seek to describe), it is likely that tests would be required under clause 5.7.7.

Example 4.

A TNSP is planning to increase an existing thermal *interconnector* limit from 1,500 MW to 1,540 MW, by the addition of series reactive control devices wholly within its own *network*, adjacent to series compensated lines.

Classification (Table 2)

This Project is being undertaken within a single *region* by a single TNSP, hence it falls under Category C in Table 2.

Does Project cause a MINI?

The upgrade is planned to lift the thermal limit by 40 MW, which is less than the 3%/50 MW stipulated in the MINI criteria. However as the reactive voltage control device is adjacent to series compensated lines, the MINI is triggered as it "has the potential to create sub-synchronous resonance, due to either:

(A) Installation of a new series capacitor; or

(B) Modification of the *network* impedance in the vicinity of an existing series capacitor.

The installation of the dynamic reactive control devices may be considered as triggering this criterion, meaning that testing under NER 5.7.7 would be required. The SISC must establish through computer modelling if the sub-synchronous resonance criteria has been triggered.

Example network testing that could be used

In this case, the area of concern is the sub-synchronous resonance associated with the new equipment. With a small increase in the *interconnector* limit (40 MW), the focus of the testing would be to demonstrate that with the new equipment there was no undamped resonance.

Testing would need to use disturbance methods likely to cause such resonance (such as tripping a circuit or applying a staged fault, bypassing the device, or dynamically varying its parameters). *Power system* measurement devices should be installed to monitor the *power system* for resonance.

Testing should commence at a lower transfer limit value until it is demonstrated that there are no resonance issues associated with the augmented system. Due to the nature of the equipment and the type of resonance that might occur, release to the full limit and monitoring with a strategy to reduce flows if required may be appropriate.

Conclusion

Without regard to the surrounding circumstances (which this example does not seek to describe), it is likely that tests would be required under clause 5.7.7.

Example 5.

A TNSP is providing a new connection to a 100 MW solar/Battery Energy Storage System (BESS) installation adjacent to a 1,000MW *interconnector*. As a result of this connection, the *interconnector* limit will be reduced to 950 MW under certain conditions.

Classification (Table 2)

This Project is being undertaken within a single *region* by a single TNSP, hence it falls under Category C in Table 2.

Does Project cause a MINI?

This Project will reduce the existing limit from 1,000 MW to 950 MW. A 50 MW reduction corresponds to 5% of the *interconnector* capacity, however the solar/BESS *generating units* will be included on the left hand side (LHS) of the *interconnector* constraint equation that will limit output as required. Testing under NER 5.7.7 may therefore not be required.

Conclusion

Without regard to the surrounding circumstances (which this example does not seek to describe), it is unlikely that tests would be required under clause 5.7.7. Testing would be undertaken under clause 5.7.3 as usual.

APPENDIX E. POWER SYSTEM MODEL DEVELOPMENT

System and Regional models created by the TNSPs should follow the process shown below. Models need to be kept appropriately updated and must reflect the anticipated system conditions for the period of interest, so any changes such as *network* changes/upgrades, anticipated generator closures, and new connections must be included. Post-commissioning, models would be validated and updated in operational systems and model / equipment databases, however is not illustrated on this diagram.

Regional model development
All TNSPs create regional models using pre-agreed input data and assumptions.

Inputs:
- Modelling information from AEMO (PSSE snapshots, PSCAD 4-state master case with associated PSSE case, and collated Mudpack models from NSPs)
- Agreed years / stages for which base cases are required
- Agreed list of transmission and generation projects to be include
- Tools + databases to automatically add projects to system models (as far as possible)
- Agreed requirements / framework for base cases

Process:
- All TNSPs independently update base case models with data for their region, according to agreed snapshot conditions.
- The developed base cases are tested and tuned.
- AEMO reviews regional base case models.
- Proponent TNSPs implement quality and change management processes

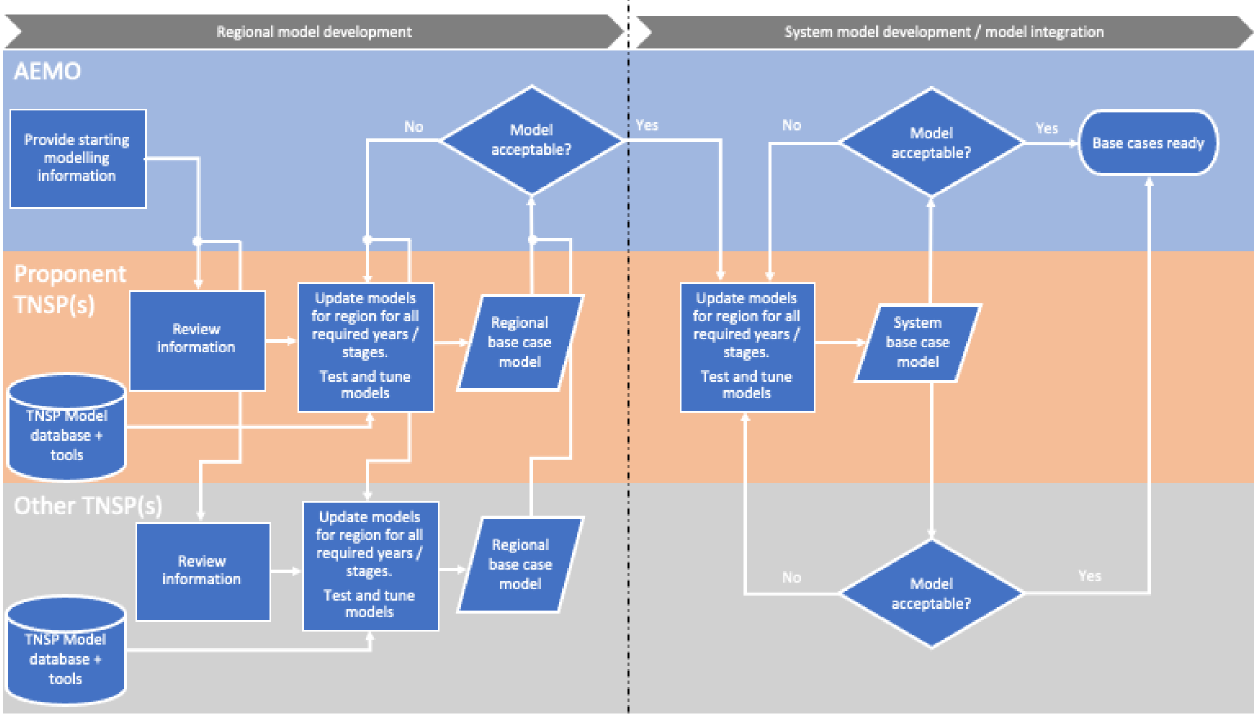
Outputs:
- Regional base case models are created for each required year / stage.

System model development / model integration
Proponent TNSPs merge regional base cases into integrated base cases.

Inputs:
- Regional base cases for agreed years / stages

Process:
- Proponent TNSPs integrate separate regional base case models into an overall model which will contain all the updates.
- The developed base cases are tested and tuned.
- AEMO and other relevant TNSPs review the final base case models.

Outputs:
- Regional base case models are created for each required year / stage.
- Cases used for:
  - Assessment of SPS requirements
  - Starting cases for development and due diligence of limit advice
  - Assessment of test requirements / opportunities



APPENDIX F. NEM INTEGRATION MODELLING WORKSTREAM

Once the SISC is established (as per the governance process proposed in Figure 1), a NEM integration modelling workstream shall be set up, either separately or within another workstream, with the following remit:

- Be convened by a representative of the *Relevant TNSP*.
- Consist of delegates from AEMO and the *Relevant TNSP*(s), who are endorsed by their organisations to make decisions appropriate to this role.
- Determine the modelling required to establish the new system limit equations (including the responsible parties and timelines for completion).
- Decide on appropriate software for modelling the *network*.
- Use this software to produce "agreed models" of the Power System suitable for determining interconnector limits.
- Provide advice on the market conditions required for testing to the market integration workstream.
- Decide on the monitoring equipment required to validate system testing (including the party responsible for its installation).
- Advise the *inter-network test*ing workstream of the testing required to validate the modelling.
- Review the results of the testing undertaken.
- Identify requirements for Special Protection Schemes.
- Recommend limit changes to the SISC.
- Liaise with relevant groups for input and advice regarding the NER 5.7.7 process, modelling and testing.

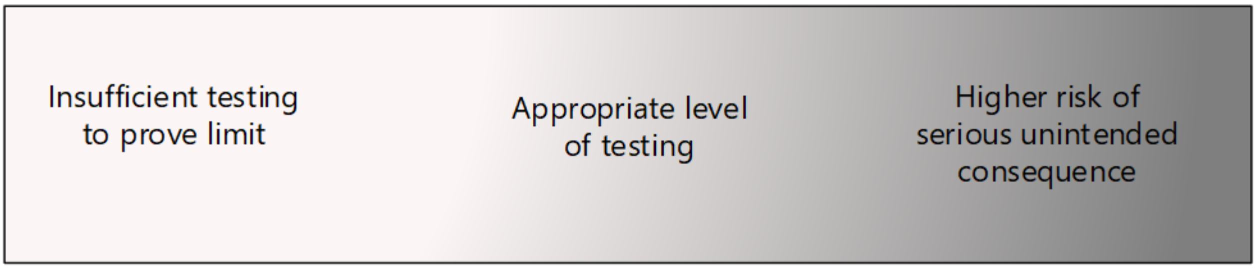
APPENDIX G. INTER-NETWORK TESTING RISK ASSESSMENT

Any *inter-network test*ing requirements identified should be considered in the context of the principles stipulated in NER 5.7.7(r), which states:

> "In determining the *test program*, *AEMO* must so far as practicable have regard to the following principles:
> 1. *power system security* must be maintained in accordance with Chapter 4; and
> 2. the variation from the *central dispatch* outcomes that would otherwise occur if there were no *inter-network test* should be minimised; and
> 3. the duration of the tests should be as short as possible consistently with test requirements and *power system security*; and
> 4. the test facilitation costs to be borne by the *Proponent* under paragraph (aa) should be kept to the minimum consistent with this paragraph."

In developing the *test program*, the risks and benefits associated with particular tests should be considered. Tests have the potential to adversely impact security, depending upon the nature of the test and *power system* conditions at the time of the test, if appropriate mitigations are not put in place, if there are unforeseen outcomes of the test or if an unforeseen event occurs simultaneously on the system.

Conversely, if tests are not adequate, issues may not be identified until after the new assets and capacity is commissioned. This could have a significant impact on *power system* security. This Appendix contains information and an example risk assessment that can be used by the *Proponent* when creating a test plan. The information here can help the *proponent* determine appropriate tests to complete, balancing the risks of testing against the benefits of completing certain tests.



Test Transfer Level

Consequences

In the event of an *interconnector* test leading to an undesirable outcome, the consequences will depend on a number of factors:

- Example: A DC *interconnector* test will be working to a limit that is set either by the physical capability of the *interconnector* itself, or the ancillary services available to compensate for its loss. Both of these factors are well-understood, and the technology can be considered mature. Therefore, it is reasonable to undertake testing up to the *interconnector* limit, with only a low probability of unintended consequence (requiring multiple system failures). It is also considered that there is a higher probability of a DC *interconnector* tripping whilst in normal service than for an AC *interconnector* (due to the more complex control /invertor systems involved), so an actual full-load test would normally be required. **Consequences: Immaterial - Minor**

- Example: Depending upon the operational conditions, validity of models to calculate the limits, and risk mitigations in place, an AC radial *interconnector* test has potential to result in system instability, resulting in widespread generation loss / demand loss (as under- and over-frequency tripping occurs) and cascading failure. **Consequences: Minor - Extreme**
- Example: Depending upon the operational conditions, validity of models to calculate the limits, and risk mitigations in place, an AC parallel *interconnector* test could result in outcomes such as localised voltage issues, leading to damage to TNSP and customer equipment. **Consequences: Minor - Major**

Likelihood

This section is looking at the likelihood of a test having detrimental unintended consequences.

For the DC *interconnector*, the likelihood is ***unlikely***, since there is adequate opportunity to test all of the supporting systems beforehand and the final, full-load testing is confirmation that all systems are working as anticipated.

For the AC *interconnector*, the likelihood is highly dependent on:

(i) How well established the technology being used is;

(ii) The level of supporting system testing undertaken (e.g. conducting end-to-end testing on automated control schemes to ensure correct operation).

Assessing Risk Rating

Risk Rating Matrix:

		CONSEQUENCE				
		Immaterial	*Minor*	*Moderate*	*Major*	*Extreme*
LIKELIHOOD	*Almost Certain*	Medium	Medium	Significant	Critical	Critical
	Likely	Low	Medium	Significant	Critical	Critical
	Possible	Low	Medium	Significant	Significant	Critical
	Unlikely	Low	Low	Medium	Medium	Significant
	Rare	Low	Low	Medium	Medium	Significant

Using the Consequences/Likelihood assessments from the above sections, the Risk Rating can be determined.

Table 3 Likelihood definitions

Likelihood	Annual probability	Description
Almost Certain	>90%	Will occur in most circumstances
Likely	51%-90%	Can be expected to occur in most circumstances
Possible	11%-50%	May occur, but not expected to in most circumstances

Likelihood	Annual probability	Description
Unlikely	1%-10%	Conceivable but unlikely to occur in any given year
Rare	<1%	Will only occur in exceptional circumstances

Table 4 Consequence definitions

Consequence	Safety	Infrastructure, assets & environment	Market	Reputational
Extreme	Single fatality or permanent injury or widespread impact on public health and/or safety.	Permanent long-term damage or affect or rectification not possible.	Loss of supply to >50% of customer demand in any one jurisdiction or >25% across multiple jurisdictions. Market suspension in multiple jurisdictions or markets.	• Significant long term damage to stakeholder confidence and relationships; • and/or Total loss of public confidence; • and/or Intensive adverse media exposure.
Major	Serious injury requiring hospitalisation > 5 days or localised impact on public health and/or safety	Significant damage or affect, difficult rectification.	Loss of supply to >25% of customer demand in any one jurisdiction or >10% across multiple jurisdictions. Market suspension in one jurisdiction or market.	• Significant short term damage to stakeholder confidence and relationships and/or; • Some loss of public confidence and/or; . • Adverse media exposure.
Moderate	Injury requiring < 5 days hospitalisation or medical treatment.	Measurable damage or affect, easy rectification.	Loss of supply to >10% of customer demand in any one jurisdiction or >5% across multiple jurisdictions. Market operating in an administered state for >5 days for gas market or >1 day for electricity market.	Some damage to stakeholder confidence and relationships
Minor	Medical treatment only.	Measurable damage or affect, no rectification required	Loss of supply to >5% of customer demand in any one jurisdiction or >2% across multiple jurisdictions. Market operating in an administered state for <5 days for gas market or <1 day for electricity market.	Manageable reduction in stakeholder confidence

Consequence	Safety	Infrastructure, assets & environment	Market	Reputational
Immaterial	First aid.	No measurable damage or affect.	No restriction of supply. No disruption to markets.	No lasting effects

Acceptable risk levels

While the ideal risk level is "low", for most testing "medium" is considered to be an acceptable risk level.

Further control measures or mitigations should be applied to any risks registering as "significant", with a view to achieving "medium" or "low" if reasonably possible (e.g. by selecting appropriate *power system* conditions for the test to be undertaken).

Risk level of "critical" is not acceptable and alternative methods of undertaking the testing should be sought.

VERSION RELEASE HISTORY

Version	Effective Date	Summary of Changes
2.0	24 September 2021	Complete review, including revised and expanded assessment criteria, a project governance structure, project examples with worked assessments, power system disturbance methods for testing and model development approach.
1.0	February 2008	First published as the Inter-Network Test Initiation Guidelines by the Inter-Regional Planning Council, continued in effect as AEMO inter-network test guidelines from 1 July 2009 under NER clause 11.28.3(b).