

Review of Commissioning and Compliance Testing Roles and Responsibilities

Input to AEMO for Connections Reform Initiative

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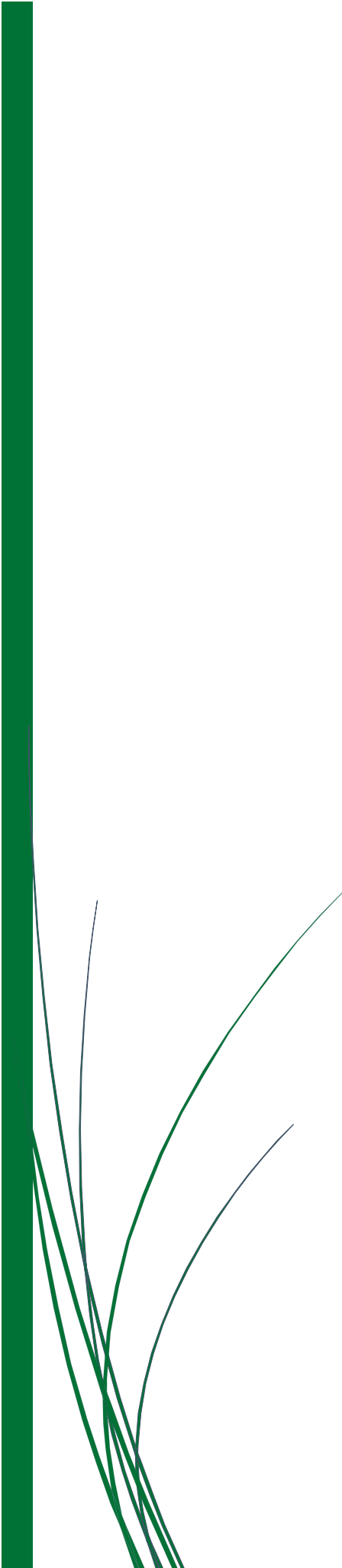


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1 INTRODUCTION

AEMO initiated a review into their current processes and practices relating to commissioning and compliance testing across the NEM. The objective of this review is to focus on the roles and responsibilities of various categories of participant in the plant commissioning and compliance testing process, to identify and document the inconsistencies and inefficiencies that may exist and consider how efficiency improvements may be derived.

The NEM is undergoing rapid energy transformation with the connection of many new generating facilities, located across all regions. These new generating facilities are primarily renewable generation systems such as wind and solar plants, with increasing levels of battery energy storage systems. There is currently immense demand for new connections services – including commissioning services.

These new connections present opportunity in the form of new energy sources to facilitate the national drive towards a net-zero electricity system, but also potential risks in the form of new technologies and less experienced design and construction teams, owners, and operators.

The commissioning and compliance testing process needs to support the completion of new generating systems in an efficient manner, while ensuring that potential risks are managed. It is critical that new facilities operate as expected, ensuring that the power system is maintained in a secure operating state, both during commissioning activities and during subsequent ongoing operations.

This review has been broken into three phases:

- 1. Review and comparison of generator commissioning and compliance testing practices across the NEM** AEMO's current commissioning and compliance testing processes and practices across the NEM (including for transmission and distribution connected plant) have been reviewed. This review has been informed by consultation with appropriate representatives from within AEMO, a selection of NSPs, Generators and engineering consultants regarding their current understanding of roles and responsibilities and their experience in commissioning and compliance testing generator projects in the NEM in recent years. The aim of the consultation was to identify and document any inconsistencies and inefficiencies that may exist. Seeking input from a range of different parties provided the opportunity to understand the process and concerns from different perspectives.
- 2. NER gap-analysis** The NER has been reviewed with respect to clarifying the stated requirements regarding plant commissioning and compliance testing. In particular, seeking to define the purpose of commissioning activities, and the roles and responsibilities of each of the activities which are often associated with commissioning and compliance testing including:
 - Hold point testing;
 - GPS compliance reporting; and
 - R2 model validation.

Development of a gap-analysis looking at where there may be differences of opinion and/or need for additional clarification.

- 3. Review of AEMO's Commissioning and Compliance Testing Guidelines and Templates** Review of AEMO's published commissioning and compliance testing guidelines and templates for consistency of the requirements and intent of the NER as established in Phase 2 of this work including:

- Generating system template for non-synchronous generation;
- Generating system template for conventional synchronous machines;
- Communication system failure guidelines;
- Guidance note – network conditions and requirements for generator commissioning; and
- Inter-network test guidelines.

Based on this review, recommendations are made on current guidelines and requirements which should be reviewed, modified or excluded.

This report summarises these activities.

2 REVIEW AND COMPARISON OF GENERATOR COMMISSIONING AND COMPLIANCE TESTING PRACTICES

2.1 Consultation Approach

To understand different perspectives and viewpoints, a direct consultation with selected parties representing a broad range of industry was conducted. This consultation sought to ensure that different experiences and viewpoints were captured. Individual consultations gave the parties the opportunity to be open, without the concerns of revealing corporate information that may have been sensitive when exposed to a wider audience.

A range of internal AEMO stakeholders, network service providers, Generators, developers and power system engineering consultants engaged in commissioning and compliance testing activities were consulted. Consultation was via discussion with each party separately, based on a standard questionnaire adapted to suit the type of organisation represented. A total of 25 consultations were conducted, the participants are listed in APPENDIX A.

The consultation sought to gain understanding of how different parties perceive their objectives; their roles and responsibilities – generally as well as specific to commissioning and compliance testing; their recent experiences - in particular risks identified, areas of good practice and poor practice; frustrations and potential areas for improvement.

Each of the consultations were productive and received vastly different responses from very positive to quite negative. All parties actively engaged with the discussions, consequently where negative views were expressed, this appeared to be with the aim of promoting further consideration and genuinely seeking to improve the process rather than merely airing past grievances.

2.2 Common Themes

The insights from each industry segment were reasonably aligned and are outlined in sections 2.3 to 2.6 below. In addition to the segment-specific concerns raised, several common themes emerged from across all segments.

The key common themes identified across all parties included:

- **Resourcing** – ensuring sufficient resourcing, continuity of resources and adequate experience levels for all parties involved in a project. Having a long-term technical engagement by all sides ensures that the unique characteristics of a site are understood, increasing the efficiency in terms of anticipating and/or resolving any issues that arise.
- **Communication** – every project, especially during commissioning is at a critical phase – in terms of power system risk, operational risk, technical matters, financial and commercial pressures. Ensuring clear concise and relevant communication between parties supports managing and balancing all these concerns. Having specific communication channels to quickly manage unforeseen issues arising during the testing processes was a widely supported process improvement. Having a mapped path for issue definition and resolution was seen as an effective means of improving timeliness and efficiency.
- **Flexibility and consistency** – there is a clear desire for consistency, but not at the expense of flexibility. Achieving a balance between these naturally opposing objectives was recognised as challenging. Many noted that within an agreed framework, means to streamline processes by adapting to the physical circumstance and understanding the specific characteristics and risks of each facility while ensuring the overarching testing objective is met, would facilitate a more efficient process. It was considered that by

providing a transparent and consistently applied framework, a fit-for-purpose commissioning and compliance testing process can be deployed.

- **Transparency** – from every perspective, parties considered they would be in a better position to support others if they had better clarity regarding situations. Means to achieve this included greater experience and understanding across industry, familiarity with projects and resource continuity would help, witnessing tests – either in person or “virtually”. Transparency was also a theme in terms of visibility of other participants conducting testing nearby and how to schedule to optimise resources at site.
- **Fit-for-purpose** Ensuring that the commissioning and compliance testing process is fit-for-purpose was often mentioned. The term fit-for-purpose was considered to be ensuring that the outcomes of the commissioning and compliance testing process are understood and achieved, rather than blindly following a process that may not facilitate the required objective. As noted above, flexibility in dealing with issues arising during the process, developing plans that aim to interrogate the matters of most concern in meeting the testing objectives, not getting lost in detail which might be interesting and sometimes concerning, but may not be specifically related to the primary objectives such as plant performance or power system security. Utilising faster methods such as “stability testing” to progress to higher capacity operation was considered a good approach when used appropriately.
- **Near-misses** It was observed that a common theme of many near-miss incidents experienced related to firmware updates and/or mis-applied settings. Ensuring processes that limit changes and updates and that encourage reliability within any change or updating activities was considered essential.
- **NER** - Limited reference to or reliance on the NER – it was notable that very few of the respondents made consistent use of the NER during the commissioning and compliance testing process. The reasoning varied and included – little information of benefit, did not want to “rock-the-boat” and prefer to collaborate to make progress, considered there were other pathways. Many stakeholders noted they tend to rely on AEMO guidance and GPS terms rather than the NER.

2.3 Feedback from AEMO teams

Each AEMO team that was consulted were very aware of and focussed on their responsibilities. They were able to identify and articulate their specific responsibilities, objectives and dependencies with respect to commissioning and compliance testing processes. Depending on the team’s functional role in the business, these range from broad to very specific.

While not always aware of other teams’ requirements, roles or objectives there did not appear to be any regions of disfunction or overlap across teams within AEMO regarding the generator commissioning and compliance testing process. Managing dissemination of information was concluded to be due to solid coordination by the relevant connections engineers and is a strong reason for ensuring one point of contact between AEMO and the Generators, as well as internally.

Teams were able to articulate specific points in the process where they required functional or information input from other teams. Any potential revision to commissioning and compliance testing processes needs to recognise these, and it is imperative to ensure that there is a mechanism to prioritise, coordinate and manage risks appropriately while ensuring that the activities of each team can be completed in a timely manner.

2.4 Feedback from Network Service Providers

2.4.1 NSP Commissioning and compliance testing Objectives

The views expressed by NSPs regarding objectives provided a level of insight to the concerns they raised regarding the commissioning and compliance testing process. The NSPs are challenged by managing competing objectives:

1. Meeting their NER obligations - protecting their network and other customers, while
2. Meeting their obligations to a new Generator – who is also a customer of varying degrees depending on the level of service the NSP has been engaged to deliver.

NSPs conveyed that adopting a conservative approach to testing and commissioning was seen as necessary for protecting the network, this may come at the expense of the Generators wishing to progress quickly through a commissioning and compliance testing process. The NSPs need to balance managing network risk against ensuring the process is efficient.

2.4.2 NSP Commissioning Processes including Guidelines, Documentation and Operational Practices

Each of the NSPs consulted had their own commissioning practices. These processes appear to have significant involvement from the NSP and each NSP considered that their processes were rigorous and appropriate to their network/s and the connections made to it.

The expectation/s of and supports provided to Generators through the commissioning and connection process were highly variable. Some NSPs maintain published documents to guide Generators through the commissioning process, others provide information directly to connection applicants through the connection process.

In terms of documentation, there was no consistent approach, some NSPs rely entirely on information published by AEMO, others have their own published documentation, and others provide more specific documentation directly to Generators once they near the commissioning phase.

Operationally, each NSPs system operations team has different engagement and involvement in the commissioning and compliance testing process. No specific concerns (or positives) were raised with respect to these teams other than that it is critical that the NSP operations teams continue to be actively engaged in the lead-up to testing and on the day of tests.

2.4.3 NSP views around issues and improvements

A consistent point of note in each of the feedback sessions was that the NSP finds themselves being the conduit that delivers multiple aims (as noted in 2.4.1 above). Firstly, they are concerned about the impact to their networks of connection and commissioning of new plant, but at the same time they find themselves managing the sometimes-competing demands of satisfying AEMO while meeting the Generator's expectation (noting that the Generator is a "paying customer" of the NSP). These competing priorities can be challenging and a juggle, the NSPs are seeking a process that allows them sufficient flexibility to adapt the commissioning and compliance testing process for each connection to the specific needs of different projects. The NSPs would support a process that can recognise where there is scope to be flexible, as well as where there needs to be additional caution applied. These feedback points align with the themes of transparency, flexibility, communication and fit-for-purpose outlined in section 2.2 above.

The NSPs also noted that new connections and commissioning processes need to accommodate **generating systems of different capacities** connecting to a wide range of network types and sometimes rigid process might not be best suited to determining the

performance aspects of most concern. In particular, a need for **an approach to manage smaller generating systems** was identified. It was mentioned that one NSP had observed a 5 MW generating system that had been required to conduct hold point testing (i.e. testing at 4 stages of capacity release). The NSP considered there was limited reason or value to adopt the hold-point style (staged capacity release) approach for that connection and expressed a view that different approaches for such situations is essential. [Note no information was provided as to why the NSP was not a leader in proposing a more pragmatic approach in that situation.]

Integrating flexibility into processes was a common theme – particularly ensuring there are frameworks to manage **commissioning and compliance testing during low wind and low irradiance conditions**. The NSPs noted that in an environment where there are both limited specialist engineering resources and limited network capacity, it is becoming more challenging when large numbers of solar facilities are stalled at final hold point over winter months and then try to conduct their final testing phase coincidentally when irradiance conditions improve in spring. Of note, often when the irradiance conditions improve, operational limits become more challenging, not only due to increased semi-scheduled generation, but also due to higher DER contributions and coincident with minimum demand conditions. The NSPs suggested methods to segregate the aspects of testing that are reliant on full output as opposed to those that rely on all plant items being in-service would help ensure plant commissioning and compliance testing can be completed in a timely manner.

A final point raised related to **managing non-compliances and firmware updates** during testing. All the NSPs appear to have experienced this and were keen to establish a clear pathway to ensure the commissioning and compliance testing processes recognise the need for such analysis and activities and provide guidance on how to approach the situation. There was concern expressed that in some situations, Generators feel that the existing NEM processes are cumbersome and try to avoid the formal 5.3.9 or S5.2.2 notifications out of fear of the need for intensive rework or studies. The NSPs suggested developing improved and universal understanding that these processes are essential as change-control safeguards and applying them flexibly would facilitate this. It is noted that AEMO is currently working with NSPs to better understand and utilise the relevant aspects of NER clauses 5.6.2, 5.6.4 and 5.7.3 to manage such issues.

All the NSPs stated they are keen to support streamlining, clarity and efficiency in the commissioning and compliance testing process.

Some NSPs expressed concerns that sometimes they cannot agree on a position with AEMO, and that in such circumstances they choose to step out of a discussion between AEMO and a Generator. This situation was raised by numerous NSPs and should be recognised by AEMO as an issue to examine and address. It is vital that the commissioning and operations practices are jointly applied given the shared responsibility of operating the power system.

2.4.4 NSP feedback on commissioning and testing of network equipment

Additional feedback was sought from NSPs with respect to commissioning of new and upgraded network equipment. The intention was to understand whether there is a similar need for review of these practices and/to whether similar practices could be applied to Generator facilities.

Only a few of the NSPs had recently conducted testing of major new or upgraded network equipment that required coordination with AEMO. On each of these occasions, the approaches were significantly different based on the type of equipment installed, its control complexity and the potential for it to have a significant system impact.

The type of equipment in this category ranged from synchronous condensers, to control systems that were intended to increase interconnector capacity.

The feedback provided by the NSPs indicated that such processes are bespoke and need to be considered based on the unique network impact and degree of coordination across many parties. No potential to streamline or simplify these activities was suggested, and no opportunity to apply similar approaches to generating systems was identified.

2.5 Feedback from Generators

2.5.1 Generator Commissioning and compliance testing Objectives

The objectives of commissioning and compliance testing for Generators were invariably linked to:

1. Project close-out and completion (finalising contracts) as soon as possible;
2. Facility able to operate to its full capacity and in “normal” mode under ongoing arrangements; and
3. Income from generation.

Fundamental to these primary objectives, a range of views were expressed regarding underlying objectives and associated drivers. The finalisation phase of bringing a new generating system online is complex – technically, financially and contractually. The underlying matters raised related to:

- Performance testing – the Generators, as principals of contracts or buyers of a facility, need to ensure that their suppliers/EPCs/consultants have delivered what is being contracted. Commissioning and compliance tests are integral to this process. There is some experience that due to uncertainty about external (NSP and AEMO) influence in commissioning processes, some contracts are either less specific regarding the required commissioning and compliance tests than a principal would prefer– to allow for flexibility, rather than have duplication of commissioning requirements to accommodate both Generator and AEMO/NSP requirements.
- Financial – commencing normal operations often activates power purchase agreements (PPAs) which sometimes have sunset clauses. Not achieving closure on these due to lingering commissioning and compliance testing items affects the end recipient (energy consumers) as well as the Generator. This is often overlooked or not considered material to AEMO or NSPs when agreeing to finalisation of a commissioning and compliance testing process.
- Contractual – practical completion, payments, warranties, operations and maintenance contracts – closing out with suppliers/EPCs/lenders enables the project to move into the next phase (i.e. commissioning is not the end of the road for the Generator, but the start of ongoing operations).
- Operational – it is typical that an EPC stays as the lead for operations of a new facility until all commissioning is complete. Generators are keen to see their normal operational team take control of a site. Where a facility remains in the commissioning phase for extended periods of time (e.g. due to minor outstanding matters or low wind/irradiance conditions) hand-over to permanent operational teams is delayed. This can affect both market participation as well as operations, maintenance, and ongoing compliance activities.

These views provided insight that in many situations the desire for expediency from a **Generator can align with AEMO’s** primary objective of ensuring proper plant performance and thereby underpinning power system security. Generators emphasised that they have long term interests with respect to ensuring commissioning and compliance testing processes are both effective and efficient.

2.5.2 Generator positive feedback on commissioning and compliance testing practices

There were 2 key aspects to current commissioning and compliance testing practices that Generators supported and would like to see continue.

AEMO and NSP participation in witness testing. Generators were overwhelmingly supportive of having AEMO and NSP staff visit facilities and to witness testing/commissioning. While witness testing has been problematic in the past due to scheduling and practical complications around site visits, the use of online tools such as *Teams* and logging into data-feeds from site recorders has facilitated remote witness testing, avoiding time and travel burdens on constrained resources. Generators expressed the view that they value AEMO and NSP staff visiting their site/s to become familiar with the project as well as practical limitations. Generators suggest that site visits at times separate from commissioning and compliance testing (i.e. not during witness testing), where Generator/EPC staff need to be focussed on the testing activities are preferred. The Generators stated that they found, where AEMO and an NSP had either visited a site and/or participated in remote/online witnessing, they were able to be better informed and could help expedite issue resolution. Witnessing testing was seen to support many of the efficiency and transparency themes identified in 2.2 above.

The use of “stability tests”. Stability tests (also referred to as staging tests by some) are a series of tests recently adopted by some but not all NSPs. These tests have been used in different forms by different NSPs, are generally applied between hold point levels and intended to demonstrate stable operation of plant and control systems for matters such as active power dispatch and voltage/reactive power control at higher output levels and with more generating units (inverters/WTG) online. These tests have been used as a mechanism to operate plant at higher output levels until such time as hold point testing and review of hold point reports has been completed. Feedback on staging tests was not without caveats, and not universally positive, but generally a practice of conducting stability tests that focus on stable plant responses and expedite or reduce workload in hold point testing was supported. If such tests became burdensome and without clear objective, support would be marginal.

2.5.3 Generator views around current issues and potential improvements

Generators were constructive in their feedback, however did express a number of frustrations regarding their recent experiences commissioning. The most raised issues were:

- Inconsistency, lack of flexibility, lack of transparency, slow process.
- **Number of hold points and tests** – understand the need to ramp up to full capacity and check for correct operation, but suggest that not all tests need to be conducted and not all need to be repeated at different output levels. In particular, repetition of tests at every hold point when there is no reason to expect a different outcome (e.g. following dispatch target when the central controller has already been tested) is inefficient. Generators would like to use a targeted approach, understanding the elements of the system that might change as new capacity is released and check performance of those.
- **“Contrived” operations** – Generators were concerned about situations where settings and plant capabilities need to be managed to ensure modelled and actual performance align perfectly when less than the full plant is operational. Generators considered that hold point testing should be conducted with plant operating under normal settings and assessment of performance and any checks of model alignment at earlier stages acknowledge that discrepancies due to limited plant being online are expected.
- **Incremental scope creep** through additional, new tests required by AEMO, but without any overarching review to remove or consolidate existing requirements that may no longer be relevant or effective.
- Model overlays during testing – there is a **perception that emphasis is on model alignment rather than plant performance**. As noted earlier, sometimes achieving

model alignment requires plant setting and model changes since the plant is only partly commissioned. These both add time and risk to the commissioning and compliance testing process.

- **Resourcing** – it was stated that continual change of personnel and lack of familiarity with a project resulted in delays during the commissioning and compliance testing process. Generators stated that where they had the benefit of long-term engagement from the AEMO or NSP side, in the form of a consistent primary technical contact, then that person was more likely to understand specific characteristics of the plant and be in a better position to take informed and timely action when issues arose as well as being able to participate more constructively in problem identification and rectification.

2.6 Feedback from Engineering Consultants

2.6.1 Engineering Consultant Commissioning and Compliance Testing Objectives

To complete the review, the perspective of power system engineering consultants who support the commissioning and compliance testing process in various roles was sought. This feedback was perceived as valuable in that engineering consultants often act for different parties in the process and may afford a more objective set of feedback compared to those who are involved on the process from a singular aspect.

As well as analytical services, engineering consultants also often deliver practical testing and commissioning services in the form of both testing engineers at site and testing/measurement/monitoring equipment. This practical perspective is valuable in the context of identifying inefficiencies and seeking improvements to the commissioning and compliance testing process.

The engineering consultants who contributed have acted for Generators, AEMO and NSPs at various times and delivered reasonably consistent feedback.

In terms of objectives from a commissioning and compliance testing process, engineering consultants were focussed on delivering to their clients' needs, acknowledging that their clients at various times are Generators, NSPs and AEMO. In that sense they also have a view to delivering good engineering practice and positive outcomes for the overall power system.

2.6.2 Engineering Consultant views around current issues and potential improvements

The main points of concern included:

- Rigidity of the process and lack of flexibility in dealing with different generating system sizes, connection locations and issues encountered.
- Slow process – this relates to initial review and approval of commissioning and compliance testing plans as well as review of the testing results, hold point reports and R2 reports.
- The number of hold points and tests within each of those hold points. These both contribute to the slow responses noted above – the more work required, the more to review and the more difficult it is to identify the matters that do require detailed investigation, review and analysis. There was a clear preference for a “less is more” approach with focus on relevance and quality rather than quantity.
- Significant frustration was expressed regarding the level of reporting – an example of 600-page hold point reports and 4,000-page R2 reports were quoted. The engineering consultants noted this is a double-edged sword. The larger reports require more work and billable hours from them, but their preference is to bill less but provide quality services to clients. Noting that this feedback is given at a time where there are limited skilled engineers available to contribute to this work.

- The different treatment of different technology was raised by engineering consultants (this was not something discussed in detail by many others, mentioned only in passing by NSPs). The engineering consultants questioned the justification for expediting testing and progress through hold points for synchronous generating systems compared with the slower approach for asynchronous plant. Given the objectives and outcomes should be similar, and some synchronous plant is of very high capacity, how can these be better aligned.
- Similar to feedback from Generators, continual scope creep through addition of tests to the testing requirements without review of the necessity and value of others is adding to the overall burden on resources and adding time to programs.

2.7 Summary of Stakeholder Consultations

Based on feedback from the stakeholders consulted, there are opportunities to develop a more efficient and focussed commissioning and compliance testing process.

The areas of concern are summarised as:

- **Hold point testing is time consuming and repetitive.** Multiple repetition of some of the tests does not offer more detailed insight into plant performance. Staged release of capacity and checking stable operation of facilities, is understood and accepted, but there is limited support for significant repetition of testing and analysis.
- **Detailed model overlays at each hold point** are not supported by engineering consultants or Generators. The commissioning and compliance testing reporting process is considered onerous and time consuming. Large volumes of reporting at each hold point delays progression, and unless there are significant compliance issues identified, do not add value to the process. The fact that specialised commissioning teams need to visit a site multiple times, sometimes across the space of many months due to delays in reporting, is considered costly and inefficient.
- **AEMO commissioning and compliance testing requirements suffer from continual ‘scope creep’** as more checks are added to ensure past mistakes by others are not repeated. It is important to ensure tests have a clear and specific purpose, are conducted at the appropriate stage/hold point and the required number of times. Any past issues should be communicated early in design and construction to facilitate better implementation, rather than adopt a check-after type approach. Noting that some aspects of ‘scope creep’ may not be directly attributable to AEMO and might instead arise from the manner in which AEMO and NSPs coordinate testing requirements between themselves.
- Differences of opinion can arise between the **prioritisation of performance testing and model validation against power system and market operations and plant safety**. Underlying risk associated with processes needs to be defined, so that where there is potential conflict, the action that takes precedence is prioritised. It also needs to be clearly understood who should be accountable for decision making.
- **Flexibility needs to be integrated** - participants are seeking flexibility within the commissioning and compliance testing process. Being able to reasonably manage testing activities for smaller sized facilities, and having methods to finalise commissioning and compliance testing when the energy source (wind/solar) is low.
- **Transparency is lacking** – poor understanding of obligations, poor transfer of information reduces the ability of participants to improve experiences and skills.

The following matters were endorsed – either to retain within or to enhance the existing processes:

- **Alignment between the objective outcomes of the commissioning and compliance testing process between different participant types.** This observation was raised several times, although also in context that it is an attribute often overlooked. By acknowledging the commonalities, it is possible to optimise the process and drive greater efficiency.
- **Consistent resourcing, clear communication, cooperation, transparency, efficiency,** adapting to circumstance, and applying fit-for-purpose processes were all highly valued aspects of a commissioning and compliance testing process. Developing practices that are applied consistently, based on system risk, and are able to adapt for circumstances where impact is low offers potential for a more efficient process. Communicating past issues to enhance understanding and improve designs.
- Using hold-point testing process to confirm **plant stability**.
- AEMO teams are highly aware of and focussed on their areas of accountability and generally address these very well.
- Having clearly defined pathways to **manage compliance** issues identified during commissioning and compliance testing.
- **Witness testing** enhances understanding of plant behaviour, operational challenges, flexible testing to conditions, problem identification and resolution. Witness testing is a useful tool in providing opportunity to enhance general knowledge and understanding of testing and commissioning practices for any office-based personnel. Remote/virtual testing is preferred as it enables the site-based personnel to be focussed on the testing activities and relieves scheduling and travel practicalities for AEMO and NSP personnel. [Note that site visits are also supported but preferred to be outside of testing windows. Such visits are considered invaluable in providing opportunities for familiarisation with a project as well as for general development experience.]

3 GAP-ANALYSIS: NATIONAL ELECTRICITY RULES AND COMMISSIONING, TESTING AND COMPLIANCE

The National Electricity Rules (NER) have been reviewed with respect to how commissioning and testing practices are integrated and regulated.

3.1 NER clauses covering commissioning, testing and compliance

Refer to APPENDIX B for a table of each NER clause that refers to commissioning and testing.

The NER covers commissioning, testing and compliance directly and indirectly under a range of clauses. The key references are as follows:

- **Clause 4.15** Requires Generators conduct GPS compliance testing– it specifies the timing, references the template for generator compliance programs¹ produced by AEMC Reliability Panel and outlines the development, review and structure of that document.
- **Clauses 5.2.1, 5.2.3 and 5.2.5** Discuss obligations around participation and cooperation in testing for different categories of participant (NSP and Generators). There are specific and enduring obligations with respect to compliance with the NER and with performance standards.
- **Clause 5.7** Provides a framework around inspection and testing of facilities, including the reasons what and circumstances where NSP/AEMO may direct testing, cost allocation and timing of tests.
- **Clause 5.8** Discusses process regarding commissioning of new and replacement equipment and provides an outline of timing for submission of plans for commissioning tests and acknowledges that plant must be commissioned and tested to demonstrate expected performance prior to operation. AEMO and NSP must agree with the testing processes and cannot allow a test that would adversely affect power system security.
- **Schedule 5.2** References commissioning in terms of applying new settings to control and protection systems, also references update of plant modelling information following commissioning to accurately reflect actual performance (R2 models).
- **Clause 8.8** Outlines the responsibilities of the Reliability Panel including publication of a template for generator compliance programs (the template), as well as regular review of the template. The template and its review are subject to the consultation guidelines.

In addition to clauses specific to testing and commissioning outlined above, there are clauses in Chapter 4 that detail AEMO's obligations with respect to power system security and the respective obligations of Network Service Providers and Registered Participants (Generators) in supporting power system security that are relevant to consideration of commissioning and compliance testing processes, roles, responsibilities and understanding past practices.

¹ [Template for Generator Compliance Programs, AEMC](#)

3.2 Stakeholder feedback on referencing the NER during commissioning and compliance testing

The feedback gained during consultations confirmed that there is limited reference by parties to the NER with respect to either the preparation of commissioning and compliance testing plans or the conduct of such tests. The main use of the NER during commissioning and compliance testing was to understand processes regarding compliance determination and/or rectification works (via clauses 4.14(p), 5.3.9 or S5.2.2) during the commissioning process.

The lack of understanding or reliance on the NER may be considered beneficial in that parties prefer to collaborate to work through the commissioning and compliance testing process and reach consensus on various matters that arise. However, the lack of reliance on the NER, appears to have caused loss/lack of knowledge or understanding about how the NER functions with respect to plant and generator commissioning and compliance. In particular, understanding of accountabilities, rights and obligations appears to be low. There appears to be minimal understanding of the structures that exist within the NER, the reasons behind various parties acting and responding to specific matters and the reasons why there is prescription around matters of responsibility.

Supporting these conclusions:

- In reviewing AEMO's guidelines^{2,3} for preparation of commissioning plans (refer to section 4 below), there are numerous references to NER clauses that do not relate directly to the matter being discussed. For example, 2 on p13 states "*Measurement equipment should be permanent to allow for compliance with clauses 4.15(b) and 5.7.3(g) of the NER.*" Neither clause 5.7.3(g) nor 4.14(b) include such a requirement. NER clause 5.7.3(g) requires maintenance of records relating to testing under 5.7, and 4.15(b) requires a Registered Participant to institute and maintain a compliance program that complies with 4.15(c). Inferring requirements and making statements such as this example can be misleading, and potentially undermine correct references to other obligations.
- The processes that appear to exist between AEMO and NSPs and the relationships between these two parties and Generators tend to provide for prescriptive guidance and input in areas that should be the responsibility of the Generator with respect to their NER obligations.
- There appears to be limited awareness of the existence of the Template for Generator Compliance Programs⁴, and as such it appears that no (or very limited) use is made of this resource in initial compliance assessment for generating systems.
- There are several test requirements in AEMO's guidelines that relate to participation in the NEM (under NER Chapters 3 and 4) that are not explicitly included in the Chapter 5 NER clauses regarding testing and commissioning (for example, check of primary frequency response capability and performance). While it is appropriate to review these items as part of initial testing as a subset of AEMO delivering its obligations with respect to market operations and power system security, it is important to understand that these are not always GPS compliance related.
- The reasons why an NSP or AEMO can require testing, and the matters under which AEMO or an NSP may reject a commissioning plan or prevent operation of a facility are defined under the NER Clauses 5.7 and 5.8. However this does not appear to be well understood.

Further, while the NER provides processes for identifying and resolving compliance matters identified prior to or during the ongoing operation of a facility, the process for initial performance and compliance testing is not specifically addressed. This may be an oversight, or it may be an

² [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Inverter-based Generation Technologies](#) and

³ [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Conventional Synchronous Machines](#)

⁴ [Template for Generator Compliance Programs](#)

indication that initial compliance assessment and reporting should be consistent with the processes applied for ongoing compliance.

3.3 The Template for Generator Compliance Programs

The Template for Generator Compliance Programs⁵ is a document prescribed under the NER (refer clause 8.8.3) and prepared by the Reliability Panel (a technical advisory group with specific composition and responsibilities under the NER, administered by the AEMC).

The Template for Generator Compliance Programs (the template), its purpose and contents are described under the NER together with provisions regarding to consultation and regular review and update. For these reasons it is considered to be a document of considerable integrity, formulated and maintained under rules, and guided by good electricity industry practice.

Reviewing this template in the context of the AEMO Testing and Commissioning guidelines and processes was considered informative and is summarised below.

The Template for Generator Compliance Programs is intended to facilitate managing the ongoing compliance of registered generating facilities with their Generator Performance Standards (GPS). As outlined in NER Clause 4.15, a Generator must institute and maintain a program of generator compliance throughout the life of a facility.

As a document intended for long term use by a Generator, and one that establishes the compliance mindset for a Generator and facilitates ongoing compliance regime after initial commissioning and compliance testing, it should provide a practical basis from which to develop a process to initially establish GPS compliance. The template is regularly reviewed under the NER to maintain alignment with current rules and practices and Generators are required to update their compliance programs consistent with any changes implemented during a review. This ensures currency of these programs.

The template is not prescriptive in the manner that the AEMO testing and commissioning guidelines are, but instead uses a set of overarching principles (refer to APPENDIX C) and suggested methodologies to outline how a Generator could structure an ongoing plan to monitor and test for compliance of their plant against its GPS. It provides a range of suggested methodologies addressing each of the clauses of a GPS, the alternative methods intended to allow for different types of technologies, connection arrangements and capacity of facilities.

One of the primary principles relates to ensuring efficiency and risk management through consideration of matters such as capacity and technology.

The guiding principles included in the template explicitly state that (among other matters) – observance of good electricity industry practice, materiality of issues addressed and included, efficiency, reflecting an equitable balance between risk management and the risk associate with conducting a test. Further discussion is included to recognise that matters such as technology, experience and relative size are all matters that might guide how the degree and frequency of testing may vary between facilities.

3.4 Summary of NER review

In summary, the NER were found to address testing, commissioning and compliance activities across a range of clauses. There is limited guidance regarding the process of compliance testing or assessment within the NER, however there are clear requirements around obligations and responsibilities of participants. These are summarised below.

⁵ [Template for Generator Compliance Programs, AEMC](#)

- **Generators** are responsible for plant performance and compliance. They have enduring obligations with respect to meeting the NER and GPS compliance.
- **Network service providers** are responsible for planning and performance of their networks.
- **AEMO** are responsible for electricity market dispatch and power system operations, including power system security.

No gaps were found with respect to the NER. However, the consultation feedback and review of existing processes indicated that there is a lack of understanding around roles, responsibilities, obligations and requirements embedded within the NER.

To ensure better understanding of how commissioning, testing and compliance is administered under the NER, it is recommended that all processes, practices, guidelines be restructured to clearly reflect and convey the relevant obligations defined in the NER.

There does appear to be a gap between the treatment of initial and ongoing compliance in the currently applied practices. To deliver improved continuity in compliance management, it is recommended that greater reference is made to the AEMC Template for Generator Compliance Programs in developing any amended processes, practices or guidelines relating to commissioning and compliance testing.

Further, aligning with the [compliance principles](#) of the AEMC template would facilitate developing a more efficient (fit for purpose) testing and commissioning process and basing the initial compliance testing of a facility on the Template for Generator Compliance Programs will enable the initial process to be immediately applied in the ongoing compliance space. This encourages consistency and continuity around compliance obligations for the lifetime of a facility. It also presents immediate efficiencies in that an enduring compliance program is developed from the outset.

4 REVIEW OF AEMO'S COMMISSIONING GUIDELINES AND TEMPLATES

4.1 Introduction

AEMO publishes two primary guidelines for reference in preparing commissioning plans, namely:

- [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Inverter-based Generation Technologies; and](#)
- [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Conventional Synchronous Machines.](#)

Each of these was reviewed at a high level, with most focus on the inverter-based technology guideline.

As well as the above guidelines, several additional documents are published on AEMO's Connection web pages dedicated to commissioning of generating systems. Of particular interest is the [Commissioning requirements for Generating Systems](#). This is published on AEMO's Connections web pages and dates from 2012, it is therefore a dated document, but does include useful descriptions of AEMO's roles in commissioning (which aligns with the NER), the legal and regulatory framework around these, as well as principles generally applied with respect to commissioning and compliance. Refer to APPENDIX D for a relevant excerpt from this document.

4.2 Findings

4.2.1 Technology specific guidelines

The reason for maintaining different guidelines for synchronous and asynchronous plant is unclear. Stakeholder feedback around this matter suggested that the different guidelines result in different processes that are not justified based on risk or outcomes. While there is sometimes a different methodology applied to the testing of different technologies, the same measures of compliance should apply given that performance standards are derived from the same principles under Schedule 5.2 of the NER.

Quoting from the Principles section in [Commissioning requirements for Generating Systems, published in 2012:](#)

“For some technology types, particularly synchronous machines, many years of commissioning activities have resulted in a well understood range of commissioning tests that demonstrate a generating system’s ability to remain safely connected to the power system.

For other technology types, industry experience is not well established and commissioning requirements are not fully developed. “

Since that time, the experience of industry with respect to other technology types has grown extensively, and while there will always be development and innovation, there should be similar good understanding that has evolved for newer technology.

It is understood that although the drivers and risks that might cause non-compliance are different between technologies, the performance criteria and their potential risk to power system security should be similar.

Each of the guidelines have been maintained separately, and consequently they have diverged in content, which may be attributed to different practices and sensitivities that have evolved over time, as much as trying to manage technological differences.

The inverter-based technologies guideline is a much larger document (running to over 70 pages) and suggests an overly prescriptive testing/commissioning, GPS compliance and R2 regime when compared to the synchronous plant guideline.

It is recommended that given the NER endeavours to be technologically neutral, consideration should be given to applying such an approach with respect to commissioning and compliance testing requirements.

4.2.2 References from the guidelines to the NER

As noted in 3.2 above, specific clauses of the NER are quoted by the AEMO Guidelines, however there are situations where the quoted clauses do not address the matter outlined in the guideline. Such references are misleading and may result in lack of observance around the obligations and accountabilities for participants.

The example quoted above is within the AEMO Guideline for asynchronous plant, which on p13 states:

Measurement equipment should be permanent to allow for compliance with clauses 4.15(b) and 5.7.3(g) of the NER.

NER clause 5.7.3(g) states:

- (g) Each *Generator* must maintain records for 7 years for each of its *generating systems* and *power stations* setting out details of the results of all technical performance and monitoring conducted under this clause 5.7.3 and make these records available to *AEMO* on request.

NER clause 4.15(b) states:

- (b) A *Registered Participant* who engages in the activity of planning, owning, controlling or operating a *plant* to which a *performance standard* applies must institute and maintain a compliance program which complies with rule 4.15(c). The compliance program must be instituted, as soon as reasonably practicable, but no later than:
 - (1) 6 months after the day that *AEMO* gives notice to the *Registered Participant* of registration of the *performance standard* under rule 4.14(n); or
 - (2) 6 months after the day on which the *plant* commences operation.

Neither of the quoted clauses relates to the quoted requirement. Inferring requirements and making statements such as this example can be misleading, and potentially undermine correct references to other obligations.

While it is certainly appropriate that measurement equipment should be permanent, the specific reasons need to be conveyed.

The AEMO Guideline should be structured to provide support and guidance, while ensuring the party accountable for activities is the party responsible for making decisions about those activities.

4.2.3 Clarity of purpose of the testing specified within the guidelines

As noted above, the AEMO guideline for asynchronous plant is large. Examining the detail within the AEMO guidelines, many tests have complex structures, prescribed methodologies and assessments and it is difficult to differentiate the specific outcomes delivered by each test. The guidelines mix activities associated with plant commissioning, compliance testing, model validation and the principles of hold-point testing under the general auspices of GPS

Compliance Assessment and R2 Model Validation. The mixture of activities results in loss in clarity with respect to accountability and purpose.

For example:

A new facility will generally be energised from its network connection point in stages. The first will be energisation of the HV switchyard, then HV transformers, MV systems and progressing to generating units. Prior to energisation, it is essential that each item of equipment goes through a rigorous commissioning process. A standard element of commissioning would be secondary injection of protection systems. This is recognised in the guidelines, as a standard prerequisite to hold-point testing. Similar to protection systems testing, it is standard practice to verify correct operation of items such as circuit breakers and transformers, including the transformer AVRs. Testing the transformer AVR is essential to ensure that voltages within the Generator's facility are managed within ratings. If transformer AVRs are incorrectly set or wired, the Generator's equipment is at risk of damage through incorrect voltage management within the facility.

The AEMO guideline requires tap changer logic tests at the initial hold-point (HP0), failing to recognise that these should have been conducted as part of the commissioning process for the transformer. Repeating such a test as a hold point adds time and complexity to the test program and the benefit is unclear.

Clear understanding of what tests are necessary for equipment commissioning purposes, and who is accountable for such tests is lost when basic activities are prescribed as the GPS Compliance and R2 model validation testing process.

4.2.4 Scope and scale of testing requirements

An issue that was raised by stakeholders regarding the current AEMO commissioning and compliance testing requirements was continual addition of tests with no consultation and no consolidation of the overall program of tests within the guidelines. Over time, this has resulted in long and extensive testing and commissioning regimes, and lack of understanding about the purpose of each test.

In isolation, most of the required tests and concerns are valid in the context of ensuring correct plant operation and AEMO's role in managing the energy market and the power system. However, when considered in the context of the overall suite of tests, the volume and duplication of activities, creates a situation where materiality, value and purpose is lost.

For example, communication system failure testing now represents a significant number of tests within the GPS Compliance and R2 testing process. While integrity of communication systems is integral to stable operation of a facility and thereby has an impact on power system security, exhaustive testing of the failure response of communication systems might concentrate focus on the wrong aspect of the communication systems. Greater attention to the integrity of the design and implementation of communication systems, together with adherence to the principles of the Power System Data Communication Standard and other aspects of GPS compliance would result in a better outcome overall.

An example of inefficiency in testing is the testing of non-preferred control modes such as reactive power and power factor control at every hold point level. It is noted and agreed that each control mode should be tested at least once, but multiple repetitions of tests adds little or no value if the performance has already been successfully demonstrated and the mode is unlikely to be deployed in practice. Similarly, testing reactive power limits under different modes of control may not be clearly testing any different functionality if the same limiter is applied regardless of the control mode. When designing a testing program, an understanding of the

structure and integration of the control systems can be used to design an efficient and targeted testing regime.

Refer to APPENDIX F for a recommended revised outline of testing at various hold point levels. This recommended outline brings together the concepts of efficient use of stability testing at interim hold point levels, with a streamlined process that focusses on normal operational modes for most tests, with secondary operating modes tested only once.

4.2.5 Scope and scale of reporting and assessment

The Guidelines require detailed reporting including model overlays of test results at each hold point level.

Feedback from the consultations indicated that there is significant time dedicated to preparing these reports and model overlays, followed by significant review time and significant delay time in assessing fine detail in actual vs modelled response.

Further, there appears to be no consistency applied with respect to how a facility is operated during the period of hold point report review and how further capacity is released. There is no clear guidance in the guidelines and each NSP has their own process. For example, some NSPs may require the Hold Point report to enable continued operation at the test level, while others allow the plant to remain at the Hold Point MW level if stability tests are witnessed and the plant's dynamic performance is deemed adequate.

It is recommended that consideration be given as to how adequate performance can be concluded from test results without disproportionate modelling and reporting burden. A concept to be considered is the use of pre-test simulation results to provide an indication of expected test outcomes and using this to compare against the measured results.

In addition to the time-consuming aspects of reporting, some practices introduce additional risk to the testing and commissioning process. There was feedback that to achieve acceptable levels of accuracy and alignment between modelled and actual response at some interim hold point levels, setting changes to parameters such as control system gain were made within plant and in models due to a facility being only partially online for that stage of testing.

In an environment where it is observed that many non-compliance incidents arise from misapplied settings, or failure to revert from temporary settings after testing, requiring setting changes for the purposes of model accuracy during interim operating levels is an example of introducing risk for limited or no benefit.

4.3 Summary

The above observations align with the feedback from stakeholders around frustrations and inefficiencies experienced during commissioning and compliance testing of plant. The structure, format and content of the existing guidelines results in lack of clarity around objectives, outcomes and accountabilities.

The NER clearly sets out the responsibilities for all activities related to operation of the NEM and the power system. Obligations for participants regarding connection, operations, managing power system security, compliance and testing and commissioning activities are all addressed in the NER. The current format of the AEMO testing and commissioning guidelines is overly prescriptive testing methods and has the potential to be inconsistent with these obligations apportioned under the NER.

The guideline/s need/s to be reframed to focus on the objectives and required outcomes of testing, together with recognising the relevant obligations and accountabilities under the NER, which should facilitate a more efficient commissioning and compliance testing process.

Finally, some practices in the commissioning and compliance testing process appear to have arisen through parties endeavouring to mitigate the risk introduced if another party did not meet their obligations. It is recommended that consideration be given to developing more sustainable ways of managing risk around inexperienced or ill-informed participants not understanding their roles (e.g. through better information transfer, education programs). Developing skills and understanding should be a secondary benefit from a different approach to commissioning and compliance testing practices. Discussed further in section 6.4 below.

4.4 Recommendations

4.4.1 A new guideline

It is recommended that a new guideline be developed rather than endeavouring to edit the existing documents. A single, consolidated guideline that addresses the requirements for all types of technologies is recommended. This will ensure that commissioning and compliance testing remains neutral to the treatment of different technologies and maintains an outcomes-based focus.

It is recommended that the new guideline be structured on a similar basis as the AEMC's [Template for Generator Compliance Programs](#) adhering to a set of principles to guide the basis for a test program, as well as providing flexibility in the methodologies suggested – ensuring that testing can be designed to suit the facility, considering its potential impact

4.4.2 Key objectives of the new guideline

A guideline that is concise, clearly defines accountabilities, addresses matters that AEMO and NSPs need to understand and agree with, provides guidance on appropriate methodologies within a flexible framework (methodologies may be a secondary document) and can be utilised by all technologies is recommended. Refer to section 3.3 above discussing the AEMC Template for Generator Compliance Programs for further discussion on the basis for a new guideline.

To achieve efficiency improvements while maintaining a high integrity commissioning and compliance testing regime, the following areas should be addressed in developing a new guideline:

- NER obligations outlined, ensure these are considered when assigning and acknowledging responsibility and obligations within the commissioning and compliance testing process.
- NER references must be direct and appropriate. Inferring and/or paraphrasing should be avoided as such practice can be misleading and does not clearly articulate obligations, roles and responsibilities.
- Clear delineation between general plant commissioning tests, GPS compliance tests and model validation tests.
- Flexibility – ensure sufficient to accommodate the range of capacities and types of facilities that may use the guideline.
- Reference supporting documents to be considered when developing testing and commissioning plans, including relevant operating procedures (such as the Power System Security Guidelines⁶ and other Power System Operating procedures) to ensure consistency is maintained.
- Focus on objectives and benefits of each test. Include tests only that deliver clear outcomes, structure testing to avoid repetition where there is no expected change to performance e.g.

⁶ [SO-OP-3715 Power System Security Guidelines](#)

SCADA systems and plant level control blocks may not change with increased capacity/ more generating units online).

- Plant stability checks should be the focus of hold-point tests at interim capacity levels.
- Provide guidance on good design practices outside of the testing and commissioning guideline. Guidance on permanently installed devices and equipment used in the testing process and future ongoing monitoring regime is relevant in the design phase of a project.
- Testing of individual plant components such as small generating units (inverters) to be limited to necessity, consider how this may be done efficiently and whether offline commissioning and compliance testing is more appropriate. The use of type-testing, bench testing or control hardware in the loop (CHIL) testing for protection settings and unit capacity may be possible.
- Avoid test methods (as far as possible) that require change to normal plant operational control systems to limit introducing risk of incorrect settings being applied and/or unintended outcomes.
- Minimise the use of model overlays. Where overlays must be used, include flexibility to accommodate that not all plant is online, any overlays should be used to confirm indicative performance only. Consider comparison to pre-test simulation results as an alternative.
- Ensure reporting requirements at intermediate operational levels are limited to what is required to confirm stable operation and expected performance. Detailed analysis should only be required where these are not demonstrated.

5 CONCLUSIONS

The stakeholder feedback, review of the NER requirements regarding testing and commissioning and AEMO guidelines review indicates that there are opportunities to improve the commissioning and compliance testing practices applied for generating systems in the NEM.

The current transformation of the energy supply system entailing the connection of many new generation facilities and retirement of existing facilities means that the need to connect (and commission) new facilities is growing exponentially. It is imperative that these activities can be conducted efficiently, while at the same time ensuring the power system remains secure and reliable and the electricity market is operated according to the National Electricity Rules.

While not part of the process, the end-use electricity customer does feel the impact of inefficient testing and commissioning activities. Delayed release of capacity into the market can have unintended consequences due to capacity shortfalls or the need to for consumers who have contracted supply via power purchase agreements to seek alternative suppliers.

An efficient process that maintains security and certainty will require active management of competing priorities. Efficiency must be achieved while understanding risk, value and materiality. Risks need to be clearly identified and managed.

To deliver the required outcomes a process must encourage ownership by participants in the process and maintain the appointed accountabilities. The NER provides a framework for understanding obligations of participants in the process – it is important that these are recognised and adhered to.

Commissioning and initial compliance assessment for a facility represents only the first stage of compliance. To foster an active and positive compliance culture, initial compliance checks should facilitate a transition to ongoing compliance. Compliance is an ongoing responsibility requiring regular monitoring, review, assessment and testing of plant. Better integration of the initial testing processes with the long-term obligations should be implemented to encourage enduring best-practice.

Areas that need to be addressed are:

- **Resourcing** Stakeholders value a single point of contact for project technical engagement – throughout the entire project including during the commissioning and compliance testing phase. The single point of contact is considered to benefit the project as background understanding and familiarity with design increases efficiency in both preparing an appropriate test schedule as well as for anticipating, identifying or resolving issues.
- **Communication** Clear, concise and relevant communication between parties is necessary to optimise resource usage. It was noted that on occasion, agreed pathways for communication has been used previously with success and this should be applied more broadly.
- **Efficient, fit-for-purpose processes** Are seen as essential to drive efficient outcomes and make best use of scarce personnel resources. Focus should be on outcomes-based testing with scope derived from risk, materiality and benefit assessments. Managing the scope and scale of hold point testing and reporting, focussing on testing for stability should be the basis for developing test procedures.
- **Flexibility AND consistency** Having processes that adapt to circumstance based on system, plant and compliance risks – as noted above regarding fit-for-purpose testing.

- **Transparency** To enhance knowledge and understanding of projects, processes and risks. Witness testing, knowledge sharing can support improved planning and conduct of testing, applying greater skill and relevant experience. Engaging respectfully and openly enables participants from all perspectives to bring a more holistic approach to testing and operating generation facilities.
- **Secure processes and avoiding near-miss events** Promoting commissioning and testing practices that reduce rather than increase power system security risks. Awareness of past compliance issues or near-miss events, in line with the observations around transparency will support this.
- **National Electricity Rules observance** Ensure roles, responsibilities and obligations of the NER are understood and adhered to, and utilise resources integral to the NER such as the Template for Generator Compliance Programs, Power System Operating Procedures and NER mandated information resources and guidelines.

The recommendations outlined in section 6 below are intended to address the above themes.

6 RECOMMENDATIONS

6.1 Overview

It is recommended that:

1. AEMO develop a new guideline for GPS Compliance testing and R2 model validation.
2. The hold point testing process be refined, to focus on efficiency and outcomes.
3. Systems to facilitate lessons learned, improving skills, knowledge and experience across industry be implemented.
4. AEMO adopts processes to support single point of technical contact for projects throughout the application, connection and commissioning phases and encourages both site visits where possible and relevant, and witnessing of tests.

Each of the recommendations are discussed in detail below and refer to APPENDIX E for a list of the themes and issues addressed via these recommendations.

6.2 A new Guideline for GPS Compliance and R2 Testing

It is recommended that AEMO, in consultation with industry including NSPs and the CRI working group, develop a new guideline to consolidate and replace all of:

1. [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Inverter-based Generation Technologies](#);
2. [GPS Compliance Assessment and R2 Model Validation Test Plan Template for Conventional Synchronous Machines](#); and
3. [Commissioning requirements for Generating Systems](#)

The new guideline should:

1. Utilise elements from the Template for Generator Compliance Programs, in particular:
 - a. Align with the Principles for Compliance,
 - b. Integrate alternative and flexible testing methodologies;
 - c. Encourage establishing long-term compliance testing and monitoring strategies from first commissioning and compliance testing – to embed a culture of active compliance.
2. Clearly outline roles and responsibilities – the 2012 document [Commissioning requirements for Generating Systems](#) has quality content regarding this and may be repurposed. Ensure that testing processes and methodologies are described only as guides and options, avoid over-prescription.
3. Adopt a principles-based framework aligned with that set out in the Template for Generator Compliance Programs – referencing the stated principles and structure that includes flexibility regarding methodologies that can be adapted to suit the facility and the circumstance.
4. Encourage enduring compliance activities by enabling application of the initial compliance testing processes within the ongoing Generator Compliance Program for a facility.
5. Be structured to optimise the number and scope of hold-point testing (refer recommendation 6.3 below) – focus on confirming stability at interim hold-point levels, and check only relevantly altered aspects of performance, avoid repetition of tests where outcome will not be different.
6. Review the level of reporting and analysis required at hold point levels – focus on ensuring that plant is performing consistent with expectation, and reasonably correlates with models; detailed review of model accuracy should be conducted only when a full facility is online and as part of the R2 validation process. Consider using pre-test simulation results to guide expected test performance.

6.3 Efficiency gains - Hold-point testing process

The number of hold points, scope for hold-point testing and the style of investigation and reporting at hold-point levels must be optimised. To facilitate this:

1. Focus on elements of risk (power system, plant, compliance), materiality, benefit, efficiency.
2. Identify and articulate actual power system risk, and how this is managed via staged release of capacity.
3. Employ stability testing to add value to the process and reduce repetition of tests that deliver little value.
4. Implement optimisations in the assessment and reporting processes – use overlays sparingly, utilise readily available material such as pre-test simulations to confirm expected performance.
5. Ensure focus is on assessing performance is according to expectation.
6. Model validation during testing should only be considered where material unexplained issues arise, otherwise it should be conducted post-testing and commissioning, as part of R2 validation process.

6.4 Upskilling

Recognising the commentary received from stakeholders and identified in the process reviews, it is imperative that experience and understanding of many aspects of the commissioning and compliance testing process are enhanced and knowledge shared.

Providing a single technical contact to support a project throughout its development and implementation (including commissioning and compliance testing) has been identified as valuable in streamlining the commissioning and compliance testing process. It is noted that retaining staff for the duration of a project as well as ensuring availability during the commissioning phase can be challenging. Similarly, ensuring that such resources are adequately skilled to fulfil such a role requires time to develop broad experience. An improved skills-base will require ongoing development and support.

To ensure that culture of continuous improvement, knowledge sharing, efficiency and proper identification and management of actual risk:

1. Create opportunities for improved practical understanding through site visits and witness testing.
2. Routinely provide shadowing support and active mentoring for developing the less experienced personnel.
3. Any information that can be used to inform and upskill both internal and external resources should be collated, recorded and shared.
4. Lessons learned materials - can deliver broader understanding of past issues identified during commissioning and compliance testing and their root causes and can be used to support better practices – across design, testing, compliance management and trouble shooting.
5. Feeding this information into an optimised process – encouraging practices that favour “design-out” rather than “test-out” solutions should be adopted.

APPENDIX A CONSULTATION SUMMARY

A.1 FEEDBACK RECORDS

Refer to: Commissioning Review - Stakeholder feedback.xlsx

A.2 CONSULTED PARTIES

A.2.1 AEMO

Metering
Operations Planning
Congestion Modelling
Grid Modelling
Congestion Modelling
National Connections
Grid Performance and Integration
Victorian Connections

A.2.2 Network Service Providers

Essential Energy (NSW DNSP)
Ausnet Services (VIC TNSP and DNSP)
Powerlink (QLD TNSP)
Electranet (SA TNSP)
Ergon Energy (QLD DNSP)

A.2.3 Generators

Iberdrola
Neoen
Acciona
Tilt
Goldwind
Total Eren
Tesla
RES
Akaysha Energy

A.2.4 Engineering Consultants

Amplitude
CPSA
Digsilent

APPENDIX B NER CLAUSES

NER Clause / Text	Precis
<p>4.15 Compliance with Performance Standards</p>	
<p>(a) A Registered Participant must:</p> <ul style="list-style-type: none"> (1) ensure that its <i>plant</i> meets or exceeds the <i>performance standard</i> applicable to its <i>plant</i>; and (2) ensure that its <i>plant</i> is not likely to cause a material adverse effect on <i>power system security</i> through its failure to comply with a <i>performance standard</i>; and (3) immediately ensure that its <i>plant</i> ceases to be likely to cause a material adverse effect on <i>power system security</i> through its failure to comply with a <i>performance standard</i>, if: <ul style="list-style-type: none"> (i) the <i>Registered Participant</i> reasonably believes that by failing to comply with a <i>performance standard</i>, its <i>plant</i> is likely to cause a material adverse effect on <i>power system security</i>; or (ii) <i>AEMO</i> advises the <i>Registered Participant</i> that by failing to comply with a <i>performance standard</i>, the <i>Registered Participant's plant</i> is likely to cause a material adverse effect on <i>power system security</i>. <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) A <i>Registered Participant</i> who engages in the activity of planning, owning, controlling or operating a <i>plant</i> to which a <i>performance standard</i> applies must institute and maintain a compliance program which complies with rule 4.15(c). The compliance program must be instituted, as soon as reasonably practicable, but no later than:</p> <ul style="list-style-type: none"> (1) 6 months after the day that <i>AEMO</i> gives notice to the <i>Registered Participant</i> of registration of the <i>performance standard</i> under rule 4.14(n); or (2) 6 months after the day on which the <i>plant</i> commences operation. <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(c) A compliance program instituted and maintained under rule 4.15(b) must:</p> <ul style="list-style-type: none"> (1) be consistent with the template for generator compliance programs; and 	<p>Generators must ensure their plant: meets or exceeds its performance standards, is unlikely to cause a material adverse impact to power system security should it be failing to comply with those standards, and cease to do so if it is considered the non-compliance would be likely to have such an affect.</p> <p>6 months after registration of performance standards or 6 months after the plant commences operation, a Generator must develop and implement a compliance monitoring program. The program must assess compliance against all GPS clauses and be developed from the Template for Generator Compliance Programs.</p> <p>The template is developed and published by the reliability panel. It is periodically reviewed, and updates are subject to</p>

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<p>(2) include procedures to monitor the performance of the <i>plant</i> in a manner that is consistent with <i>good electricity industry practice</i>; and</p> <p>(3) be modified to be consistent with any amendments made under clause 8.8.3(ba) to the <i>template for generator compliance programs</i>, by no later than 6 months after amendments to the <i>template for generator compliance programs</i> are published or by a date determined by the <i>Reliability Panel</i>; and</p> <p>(4) provide reasonable assurance of ongoing compliance with each applicable <i>performance standard</i>.</p> <p>(ca) The template for generator compliance programs must:</p> <p>(1) cover all performance standards; and</p> <p>(2) define suitable testing and monitoring regimes for each <i>performance standard</i> so that a <i>Registered Participant</i> can select a regime that complies with the obligations set out in rules 4.15(a), 4.15(b) and 4.15(c) for their particular <i>plant</i>.</p> <p>(d) The <i>AER</i> may request that a <i>Registered Participant</i>, who is required to institute and maintain a compliance program in accordance with rule 4.15(b) or clause 5.7.4(a1), deliver to the <i>AER</i>:</p> <p>(1) the compliance program records setting out the written results of the performance monitoring conducted in accordance with rule 4.15(f) or clause 5.7.4(a2)(1); and</p> <p>(2) any other records maintained in accordance with clause 5.7.3 or clause 5.7.4, if applicable.</p> <p>(e) Each <i>Registered Participant</i> must maintain the compliance program records and any other records developed or maintained under clause 5.7.3 or clause 5.7.4 for 7 years and deliver such records to the <i>AER</i>, in accordance with rule 4.15(d), within 5 <i>business days</i> of the date of the request or such further period as the <i>AER</i> requires.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(f) A <i>Registered Participant</i> who engages in the activity of planning, owning, controlling or operating a <i>plant</i> to which a <i>performance standard</i> applies must immediately notify <i>AEMO</i> if:</p> <p>(1) the <i>Registered Participant</i> becomes aware that the <i>plant</i> is breaching a <i>performance standard</i> applicable to the <i>plant</i>; or</p> <p>(2) the <i>Registered Participant</i> reasonably believes that the <i>plant</i> is likely to breach a <i>performance standard</i> applicable to the <i>plant</i>, and <i>AEMO</i> must forward a copy of that notice to the <i>AER</i> and the relevant <i>Network Service Provider</i> no later than 5 <i>business days</i> from the day on which <i>AEMO</i> received the notice.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(g) A notice in accordance with rule 4.15(f) must detail:</p>	<p>consultation procedures (see NER clause 8.8.3)</p> <p>The AER may request the compliance plan records and any other records - references to 5.7 and 4.15.</p>
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<p>(1) the reason for the actual or likely non-conformance of the <i>plant</i> with the <i>performance standard</i>;</p> <p>(2) the actual or likely time of commencement of non-conformance of the <i>plant</i> with the <i>performance standard</i>;</p> <p>(3) the expected duration of non-conformance of the <i>plant</i> with the <i>performance standard</i>; and</p> <p>(4) the expected performance of the <i>plant</i> in comparison with the <i>performance standard</i>.</p> <p>(h) A <i>Registered Participant</i> who has notified <i>AEMO</i> in accordance with rule 4.15(f), must notify <i>AEMO</i> and the relevant <i>Network Service Provider</i> that its <i>plant</i> has returned to compliance with the <i>performance standard</i> immediately following the <i>Registered Participant</i> becoming aware of the return of the <i>plant</i> to compliance with the <i>performance standard</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(i) If:</p> <p>(1) a <i>Registered Participant</i> notifies <i>AEMO</i> in accordance with rule 4.15(f); or</p> <p>(2) <i>AEMO</i> otherwise reasonably believes that the <i>plant</i> of a <i>Registered Participant</i>, in respect of which a <i>performance standard</i> applies, is in breach of that <i>performance standard</i>,</p> <p>then:</p> <p>(3) <i>AEMO</i> must, in accordance with rule 4.15(j), notify the <i>Registered Participant</i> and the relevant <i>Network Service Provider</i> of its determination on the period within which the <i>Registered Participant</i> must rectify the breach; and</p> <p>(4) <i>AEMO</i> must notify the <i>AER</i> of a breach notified in accordance with rule 4.15(i)(1) or of its reasonable belief of a breach in accordance with rule 4.15(i)(2), as the case may be; and</p> <p>(5) the <i>Registered Participant</i> must rectify the breach within that period, unless the <i>Registered Participant</i> seeks a review from the <i>AER</i> of the rectification period under rule 4.15(n).</p> <p>(j) <i>AEMO</i> must, when determining the period within which a <i>Registered Participant</i> is required to rectify a <i>performance standard</i> breach in accordance with rule 4.15(i), take into consideration:</p> <p>(1) the time that <i>AEMO</i>, in its reasonable opinion, considers necessary to provide the <i>Registered Participant</i> with the opportunity to remedy the breach; and</p> <p>(2) the impact on the operation of the <i>NEM</i>, including on the <i>power system</i> and the <i>spot market</i>, resulting from the breach; and</p> <p>(3) any actions required by <i>AEMO</i> in response to the breach.</p> <p>(n) If <i>AEMO</i> notifies a <i>Registered Participant</i> of a rectification period under rule 4.15(i) and that <i>Registered Participant</i> considers that <i>AEMO</i> has not reasonably applied the criteria under rule 4.15(j) with respect to the rectification period, the <i>Registered Participant</i> may, no later than 20 <i>business days</i> from the day of receiving <i>AEMO</i>'s notification on the rectification period, make an application to the <i>AER</i> requesting a review of <i>AEMO</i>'s notification and the <i>Registered Participant</i>'s reasons for a review.</p>	
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<p>(o) If the <i>AER</i> receives an application under rule 4.15(n), the <i>AER</i> must review the application, no later than 30 <i>business days</i> from receiving the application, and either:</p> <ul style="list-style-type: none"> (1) accept the rectification period determined by <i>AEMO</i>; or (2) determine the rectification period on the <i>Registered Participant</i>, and provide reasons in writing for its determination to the <i>Registered Participant</i>, <i>AEMO</i> and the relevant <i>Network Service Provider</i>. <p>(p) The <i>Registered Participant</i> must comply with any determination on the rectification period made under rule 4.15(o) from the day of receiving the <i>AER</i>'s determination.</p> <p>(q) If the <i>plant</i> of a <i>Registered Participant</i> remains operating in a manner that is in breach of a <i>performance standard</i> for a period greater than that determined in accordance with rule 4.15(i) or 4.15(o), <i>AEMO</i> must notify the <i>AER</i> and the relevant <i>Network Service Provider</i>.</p>	
<p>5.1A.2 Principles</p>	
<p>This Part B is based on the following principles relating to <i>connection</i> to the <i>national grid</i>:</p> <ul style="list-style-type: none"> (a) all <i>Registered Participants</i> should have the opportunity to form a <i>connection</i> to a <i>network</i> and have access to the <i>network services</i> provided by the <i>networks</i> forming part of the <i>national grid</i>, except that if the <i>connection</i> is to a part of a <i>network</i> that is a <i>designated network asset</i> then that <i>connection</i> and access will be subject to the relevant <i>access policy</i> for that <i>designated network asset</i>; (b) the terms and conditions on which <i>connection</i> to a <i>network</i> and provision of <i>network service</i> is to be granted are to be set out in commercial agreements on reasonable terms entered into between a <i>Network Service Provider</i> and other <i>Registered Participants</i>; (c) the technical terms and conditions of <i>connection agreements</i> regarding standards of performance must be established at levels at or above the <i>minimum access standards</i> set out in schedules 5.1, 5.2, 5.3 and 5.3a, with the objective of ensuring that the <i>power system</i> operates securely and reliably and in accordance with the <i>system standards</i> set out in schedule 5.1a; (e) the operation of the <i>Rules</i> should result in the achievement of: <ul style="list-style-type: none"> (1) long term benefits to <i>Registered Participants</i> in terms of cost and <i>reliability</i> of the <i>national grid</i>; and (2) open communication and information flows relating to <i>connections</i> between <i>Registered Participants</i> themselves, and between <i>Registered Participants</i> and <i>AEMO</i>, while ensuring the security of <i>confidential information</i> belonging to competitors in the <i>market</i>. 	
<p>5.2.1 Obligations of Registered Participants</p>	
<ul style="list-style-type: none"> (a) All <i>Registered Participants</i> must maintain and operate (or ensure their authorised <i>representatives</i> maintain and operate) all equipment that is part of their <i>facilities</i> in accordance with: <ul style="list-style-type: none"> (1) relevant laws; (2) the requirements of the <i>Rules</i>; and 	<p>Registered Participants have specific and enduring obligations regarding compliance with the NER and performance standards.</p>

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<p>(3) good electricity industry practice and relevant Australian Standards.</p> <p>(b) All <i>Registered Participants</i> must ensure that the <i>connection agreements</i> to which they are a party require the provision and maintenance of all required <i>facilities</i> consistent with <i>good electricity industry practice</i> and must operate their equipment in a manner:</p> <p>(1) to assist in preventing or controlling instability within the <i>power system</i>;</p> <p>(2) to comply with their <i>performance standards</i>;</p> <p>(3) to assist in the maintenance of, or restoration to, a <i>satisfactory operating state</i> of the <i>power system</i>; and</p> <p>(4) to prevent uncontrolled separation of the <i>power system</i> into isolated <i>regions</i> or partly combined <i>regions</i>, <i>intra-regional transmission</i> break-up, or <i>cascading outages</i>, following any <i>power system</i> incident.</p>	
<p>5.2.3 Obligations of network service providers</p>	
<p>(d) A Network Service Provider must:</p> <p>....</p> <p>(5) permit and participate in inspection and testing of <i>facilities</i> and equipment in accordance with rule 5.7;</p> <p>(6) permit and participate in commissioning of <i>facilities</i> and equipment which are to be <i>connected</i> to its <i>network</i> in accordance with rule 5.8;</p>	<p>NSPs are involved in the commissioning of facilities connecting to their network.</p>
<p>5.2.5 Obligations of Generators</p>	
<p>(a) A <i>Generator</i> must plan and design its <i>facilities</i> and ensure that they are operated to comply with:</p> <p>(1) the performance standards applicable to those facilities;</p> <p>(2) subject to subparagraph (1), its <i>connection agreement</i> applicable to those <i>facilities</i>; and</p> <p>(3) subject to subparagraph (2), the <i>system standards</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) A <i>Generator</i> must:</p> <p>(1) ...;</p> <p>(4) permit and participate in inspection and testing of <i>facilities</i> and equipment in accordance with rule 5.7;</p> <p>(5) permit and participate in commissioning of <i>facilities</i> and equipment which are to be <i>connected</i> to a <i>network</i> for the first time in accordance with rule 5.8; and</p>	<p>Generators have obligations when connecting equipment to a network and must facilitate inspection and testing of equipment. Generators must also commission equipment according to the provisions of Clause 5.8.</p>
<p>5.3.10 Acceptance of performance standards for generating plant that is altered</p>	

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<p>(a) A <i>Generator</i> must not commission altered <i>generating plant</i> until the <i>Network Service Provider</i> has advised the <i>Generator</i> that the provider and <i>AEMO</i> are satisfied in accordance with paragraph (b). ...</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	<p>If a <i>Generator</i> modifies its plant, it must go through a commissioning process, and this cannot occur without <i>NSPs/AEMO</i> approving the modification and associated <i>GPS</i> updates.</p>
<p>5.3A.3 Publication of Information</p>	
<p>(a) A <i>Distribution Network Service Provider</i> must <i>publish</i> the following in the same location on its website:</p> <p>...</p> <p>(3) an information pack.</p> <p>(b) An <i>information pack</i> must include:</p> <p>...</p> <p>(6) technical requirements relevant to the processing of a <i>connection</i> enquiry or an <i>application to connect</i>, including information of the type, but not limited to:</p> <p>...</p> <p>(x) commissioning and testing requirements; and ...</p>	<p>A <i>DNSP</i> is required to publish commissioning and testing requirements for embedded generators (i.e. generators connecting to a distribution network).</p>
<p>5.6.2 Advice of inconsistencies</p>	
<p>(a) At any stage prior to commissioning the <i>facility</i> in respect of a <i>connection</i> if there is an inconsistency between the proposed equipment and the <i>connection agreement</i> including the <i>performance standards</i>, the <i>Registered Participant</i> or the person intending to be registered as a <i>Generator</i> must:</p> <p>(1) advise the relevant <i>Network Service Provider</i> and, if the inconsistency relates to <i>performance standards</i>, <i>AEMO</i>, in writing of the inconsistency; and</p> <p>(2) if necessary, negotiate in good faith with the <i>Network Service Provider</i> any necessary changes to the <i>connection agreement</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) If an inconsistency in a <i>connection agreement</i> including a <i>performance standard</i> is identified under paragraph (a), the <i>Registered Participant</i> or the person intending to be registered as a <i>Generator</i> and the <i>Network Service Provider</i> must not commission the <i>facility</i></p>	<p>Commissioning of a facility cannot commence if an inconsistency between proposed equipment and installed equipment would affect performance according to the generator's performance standards.</p> <p>If this occurs and cannot be rectified, good faith negotiations of <i>GPS</i> modifications must be resolved prior to commissioning.</p>

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<p>in respect of a <i>connection</i> unless the <i>facility</i> or the <i>connection agreement</i> or <i>performance standard</i> has been varied to remove the inconsistency.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	
<p>5.6.4 Advice on possible non-compliance</p>	
<p>(a) If the relevant <i>Network Service Provider</i> reasonably believes that the design of a proposed <i>facility</i> has potential to adversely and materially affect the performance of the <i>power system</i>, the <i>Network Service Provider</i> may require the <i>Registered Participant</i> to submit to it specified design information and drawings to enable the <i>Network Service Provider</i> to assess the performance of the <i>facility</i> in respect of its interaction with the <i>power system</i>:</p> <p>(1) after the <i>Registered Participant</i> has entered into an agreement for the supply of <i>plant</i> or associated equipment to be connected; and</p> <p>(2) when the relevant contractor's designs have progressed to a point where preliminary designs are available but prior to manufacture of equipment.</p> <p>(b) The <i>Network Service Provider</i> must, within 40 <i>business days</i> of receipt of such information, use its reasonable endeavours to advise the <i>Registered Participant</i> in writing of any design deficiencies which the <i>Network Service Provider</i> believes would cause the design to be inconsistent with the <i>connection agreement</i> or the <i>Rules</i>.</p> <p>(c) Notwithstanding paragraph (b), it is the <i>Registered Participant's</i> sole responsibility to ensure that all <i>plant</i> and equipment associated with the <i>connection</i> complies with the <i>connection agreement</i> and the <i>Rules</i>.</p>	<p>Each Registered Participant has responsibility with respect to compliance of their plant.</p>
<p>5.7 Inspection and Testing</p>	
<p>5.7.1 Right of entry and inspection</p>	
<p>(a) If a <i>Registered Participant</i> who is party to a <i>connection agreement</i> reasonably believes that the other party to the <i>connection agreement</i> (being a party who is also a <i>Registered Participant</i>) is not complying with a technical provision of the <i>Rules</i> and that, as a consequence, the first <i>Registered Participant</i> is suffering, or is likely to suffer, a material adverse effect, then the first <i>Registered Participant</i> may enter the relevant <i>facility</i> at the <i>connection point</i> of the other <i>Registered Participant</i> in order to assess compliance by the other <i>Registered Participant</i> with its technical obligations under the <i>Rules</i>.</p> <p>(b) A <i>Registered Participant</i> who wishes to inspect the <i>facilities</i> of another <i>Registered Participant</i> under clause 5.7.1(a) must give that other <i>Registered Participant</i> at least 2 <i>business days</i> notice of its intention to carry out an inspection.</p>	<p>Under certain conditions, a registered participant who is party to a connection agreement, or AEMO can request inspection of a registered participant's facilities.</p> <p>A registered participant who</p>

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- (c) A notice given under clause 5.7.1(b) must include the following information:
 - (1) the name of the *representative* who will be conducting the inspection on behalf of the *Registered Participant*;
 - (2) the time when the inspection will commence and the expected time when the inspection will conclude; and
 - (3) the nature of the suspected non-compliance with the *Rules*.
- (d) Neither a *Registered Participant* nor *AEMO* may carry out an inspection under this rule 5.7 within 6 *months* of any previous inspection except for the purpose of verifying the performance of corrective action claimed to have been carried out in respect of a non-conformance observed and documented on the previous inspection or (in the case of *AEMO*) for the purpose of reviewing an operating incident in accordance with clause 4.8.15.
- (e) At any time when the representative of a Registered Participant is in another Registered Participant's facility, that representative must:
 - (1) cause no damage to the *facility*;
 - (2) only interfere with the operation of the *facility* to the extent reasonably necessary and approved by the relevant *Registered Participant* (such approval not to be unreasonably withheld or delayed); and
 - (3) observe "permit to test" access to sites and clearance protocols of the operator of the *facility*, provided that these are not used by the operator of the *facility* solely to delay the granting of access to site and inspection.
- (f) Any *representative* of a *Registered Participant* conducting an inspection under this clause 5.7.1 must be appropriately qualified to perform the relevant inspection.
- (g) The costs of inspections under this clause 5.7.1 must be borne by the *Registered Participant* requesting the inspection.
- (h) *AEMO* or any of its *representatives* may, in accordance with this rule 5.7, inspect a *facility* of a *Registered Participant* and the operation and maintenance of that *facility* in order to:
 - (1) assess compliance by the relevant *Registered Participant* with its operational obligations under Chapter 3 or 4, or an *ancillary services agreement*;
 - (2) investigate any possible past or potential threat to *power system security*; or
 - (3) conduct any periodic familiarisation or training associated with the operational requirements of the *facility*.
- (i) Any inspection under clause 5.7.1(a) or (h) must only be for so long as is reasonably necessary.
- ...
- (l) A *Registered Participant* (in the case of an inspection carried out under clause 5.7.1(a)) or *AEMO* (in the case of an inspection carried out under clause 5.7.1(h)) must provide the results of that inspection to the *Registered Participant* whose *facilities* have been inspected, any other *Registered Participant* which is likely to be materially affected by the results of the test or inspection and *AEMO* (in the case of an inspection carried out under clause 5.7.1(a)).

reasonably believes the facility is not complying with a technical aspect of the NER and this is likely to cause a **material impact** to them may make such a request.

AEMO may make such a request to assess compliance with **chapters 3 or 4 or an ancillary services agreement**, to assess a past or potential **threat to power system security**, or for familiarisation purposes.

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<p>Note</p> <p>This paragraph is classified as a tier 3 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	
<p>5.7.2 Right of testing</p>	
<p>(a) A <i>Registered Participant</i>, who has reasonable grounds to believe that equipment owned or operated by a <i>Registered Participant</i> with whom it has a <i>connection agreement</i> (which equipment is associated with the <i>connection agreement</i>) may not comply with the <i>Rules</i> or the <i>connection agreement</i>, may request testing of the relevant equipment by giving notice in writing to the other <i>Registered Participant</i>.</p> <p>(b) If a notice is given under clause 5.7.2(a) the relevant test is to be conducted at a time agreed by <i>AEMO</i>.</p> <p>(c) The <i>Registered Participant</i> who receives a notice under clause 5.7.2(a) must co-operate in relation to conducting tests requested under clause 5.7.2(a).</p> <p>(d) The cost of tests requested under clause 5.7.2(a) must be borne by the <i>Registered Participant</i> requesting the test, unless the equipment is determined by the tests not to comply with the relevant <i>connection agreement</i> and the <i>Rules</i>, in which case all reasonable costs of such tests must be borne by the owner of that equipment.</p> <p>(e) Tests conducted in respect of a <i>connection point</i> under clause 5.7.2 must be conducted using test procedures agreed between the relevant <i>Registered Participants</i>, which agreement is not to be unreasonably withheld or delayed.</p> <p>(f) Tests under clause 5.7.2 must be conducted only by persons with the relevant skills and experience.</p> <p>(g) A <i>Transmission Network Service Provider</i> must give <i>AEMO</i> adequate prior notice of intention to conduct a test in respect of a <i>connection point</i> to that <i>Network Service Provider's network</i>.</p> <p>(h) The <i>Registered Participant</i> who requests a test under this clause 5.7.2 may appoint a <i>representative</i> to witness a test and the relevant <i>Registered Participant</i> must permit a <i>representative</i> appointed under this clause 5.7.2(h) to be present while the test is being conducted.</p>	<p>A registered participant who has a connection agreement with another registered participant (e.g. and NSP) who has reasonable grounds to believe that a facility with which it has a connection agreement is not compliant with that agreement or the Rules may request testing.</p> <p>e.g. an NSP may request testing for GPS compliance purposes, AEMO is not mentioned.</p> <p>There are processes around agreeing to the tests required, the timing and witnessing.</p>
<p>Note</p> <p>This paragraph is classified as a tier 3 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(i) A <i>Registered Participant</i> who conducts a test must submit a report to the <i>Registered Participant</i> who requested the relevant test, <i>AEMO</i> and to any other <i>Registered Participant</i> which is likely to be materially affected by the results of the test, within a reasonable period after the completion of the test and the report is to outline relevant details of the tests conducted, including but not limited to the results of those tests.</p> <p>Note</p> <p>This paragraph is classified as a tier 3 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	

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<p>(j) A <i>Network Service Provider</i> may attach test equipment or <i>monitoring equipment</i> to <i>plant</i> owned by a <i>Registered Participant</i> or require a <i>Registered Participant</i> to attach such test equipment or <i>monitoring equipment</i>, subject to the provisions of clause 5.7.1 regarding entry and inspection.</p> <p>(k) In carrying out monitoring under clause 5.7.2(j) the <i>Network Service Provider</i> must not cause the performance of the monitored <i>plant</i> to be <i>constrained</i> in any way.</p>	
<p>5.7.3 Tests to demonstrate compliance with connection requirements for generators</p>	
<p>(a) Each <i>Generator</i> must, in accordance with the time frames specified in rule 4.15, provide evidence to any relevant <i>Network Service Provider</i> with which that <i>Generator</i> has a <i>connection agreement</i> and to <i>AEMO</i>, that its <i>generating system</i> complies with:</p> <ol style="list-style-type: none"> (1) the applicable technical requirements of clause S5.2.5; and (2) the relevant connection agreement including the performance standards. <p>Note</p> <p>This paragraph is classified as a tier 3 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(c) If a test required by clause 5.7.3(a) demonstrates that a <i>generating system</i> is not complying with one or more technical requirements of clause S5.2.5 or the relevant <i>connection agreement</i> or one or more of the <i>performance standards</i> then the <i>Generator</i> must:</p> <ol style="list-style-type: none"> (1) promptly notify the relevant <i>Network Service Provider</i> and <i>AEMO</i> of that fact; and (2) promptly notify the <i>Network Service Provider</i> and <i>AEMO</i> of the remedial steps it proposes to take and the timetable for such remedial work; and (3) diligently undertake such remedial work and report at monthly intervals to the <i>Network Service Provider</i> on progress in implementing the remedial action; and (4) conduct further tests or monitoring on completion of the remedial work to confirm compliance with the relevant technical requirements or <i>performance standards</i> (as the case may be). <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(d) If <i>AEMO</i> reasonably believes that a <i>generating system</i> is not complying with one or more applicable <i>performance standards</i> or one or more applicable technical requirements of clause S5.2.5 or the relevant <i>connection agreement</i>, <i>AEMO</i> may instruct the <i>Generator</i> to conduct tests within 25 <i>business days</i> to demonstrate that the relevant <i>generating system</i> complies with those <i>performance standards</i> or technical requirements.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	<p>A <i>Generator</i> must provide evidence to their NSP and <i>AEMO</i> within the timeframes of 4.15 (6 months) that they comply with the technical requirements of S5.2.5, their connection agreement including each clause of their GPS.</p> <p>The clause provides a process if test indicate there is a GPS non-compliance.</p>

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<p>(e) If the tests undertaken in accordance with paragraph (d) provide evidence that the <i>generating system</i> continues to comply with those requirements <i>AEMO</i> must reimburse the <i>Generator</i> for the reasonable expenses incurred as a direct result of conducting the tests.</p> <p>(f) If <i>AEMO</i>:</p> <p>(1) is satisfied that:</p> <p>(i) a <i>generating system</i> is not complying with the relevant <i>performance standards</i> for that system in respect of one or more of the technical requirements contained in S5.2.5, S5.2.6, S5.2.7 or S5.2.8 and the relevant <i>connection agreement</i>; or</p> <p>(ii) a <i>generating system's</i> performance is not adequately represented by the applicable analytical model provided under clause 5.7.6(h) or clause S5.2.4; and</p> <p>(2) holds the reasonable opinion that the performance of the <i>generating system</i>, or inadequacy of the applicable analytical model of the <i>generating system</i> is or will impede <i>AEMO's</i> ability to carry out its role in relation to <i>power system security</i>,</p> <p><i>AEMO</i> may direct the relevant <i>Generator</i> to operate the <i>generating system</i> at a particular <i>generated</i> output or in a particular mode until the relevant <i>Generator</i> submits evidence reasonably satisfactory to <i>AEMO</i> that the <i>generating system</i> is complying with the relevant <i>performance standard</i> and performing substantially in accordance with the applicable analytical model.</p> <p>(g) Each <i>Generator</i> must maintain records for 7 years for each of its <i>generating systems</i> and <i>power stations</i> setting out details of the results of all technical performance and monitoring conducted under this clause 5.7.3 and make these records available to <i>AEMO</i> on request.</p>	
<p>5.7.3A Tests to demonstrate compliance with system strength remediation schemes</p>	
<p>(a) Each <i>Registered Participant</i> required under a <i>connection agreement</i> to implement a <i>system strength remediation scheme</i> by means of <i>facilities</i> owned, operated or controlled by the <i>Registered Participant</i> must at the request of <i>AEMO</i> or the relevant <i>Network Service Provider</i> made not more than once in a calendar year provide evidence that those <i>facilities</i> satisfy the requirements of the <i>system strength remediation scheme</i> set out in the <i>connection agreement</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) If at any time the <i>facilities</i> do not satisfy the requirements of the <i>system strength remediation scheme</i> set out in the <i>connection agreement</i>, the <i>Registered Participant</i> must:</p> <p>(1) promptly notify the relevant <i>Network Service Provider</i> and <i>AEMO</i> of that fact;</p> <p>(2) promptly notify the <i>Network Service Provider</i> and <i>AEMO</i> of the remedial steps it proposes to take and the timetable for such remedial work;</p> <p>(3) diligently undertake such remedial work and report at monthly intervals to the <i>Network Service Provider</i> on progress in implementing the remedial action; and</p>	<p>Addresses testing specific to system strength remediation schemes</p>

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<p>(4) conduct further tests or monitoring on completion of the remedial work to confirm compliance with the requirements of the <i>system strength remediation scheme</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(c) If <i>AEMO</i> reasonably believes the requirements of a <i>system strength remediation scheme</i> are not being complied with, <i>AEMO</i> may instruct the <i>Registered Participant</i> to conduct tests within <i>25 business days</i> to demonstrate that the requirements are being met.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(d) If the tests undertaken in accordance with paragraph (c) provide evidence that the requirements of a <i>system strength remediation scheme</i> are being complied with, <i>AEMO</i> must reimburse the <i>Registered Participant</i> for the reasonable expenses incurred as a direct result of conducting the tests.</p> <p>(e) If <i>AEMO</i>:</p> <p>(1) is satisfied that the requirements of a <i>system strength remediation scheme</i> are not being complied with; and</p> <p>(2) holds the reasonable opinion that the failure is impeding or will impede <i>AEMO's</i> ability to carry out its role in relation to <i>power system security</i>,</p> <p><i>AEMO</i> may direct the relevant <i>Registered Participant</i> to operate its <i>facility</i> at a particular output or <i>power transfer capability</i> or in a particular mode until the relevant <i>Registered Participant</i> submits evidence reasonably satisfactory to <i>AEMO</i> that the requirements of the <i>system strength remediation scheme</i> are being complied with.</p> <p>(f) Each <i>Registered Participant</i> referred to in paragraph (a) must maintain records for 7 years for each of its relevant <i>facilities</i> setting out details of the results of monitoring and testing conducted under this clause 5.7.3A and make these records available to <i>AEMO</i> on request.</p>	
<p>5.7.5 Testing by Registered Participants of their own plant requiring changes to normal operation</p>	
<p>(a) A <i>Registered Participant</i> proposing to conduct a test on equipment related to a <i>connection point</i>, which requires a change to the normal operation of that equipment, must give notice in writing to the relevant <i>Network Service Provider</i> of at least <i>15 business days</i> except:</p> <p>(1) in an emergency; or</p> <p>(2) where <i>AEMO</i> has notified the relevant <i>Network Service Provider</i> of the proposed date and time of a test of the <i>Registered Participant's</i> equipment to be conducted in accordance with the requirements of the <i>SRAS Guideline</i>, under an <i>ancillary services agreement</i> between <i>AEMO</i> and the <i>Registered Participant</i>.</p>	<p>Procedures regarding participants testing that affects normal operations.</p>

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<p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) The notice to be provided under clause 5.7.5(a) must include:</p> <ol style="list-style-type: none"> (1) the nature of the proposed test; (2) the estimated start and finish time for the proposed test; (3) the identity of the equipment to be tested; (4) the <i>power system</i> conditions required for the conduct of the proposed test; (5) details of any potential adverse consequences of the proposed test on the equipment to be tested; (6) details of any potential adverse consequences of the proposed test on the <i>power system</i>; and (7) the name of the person responsible for the co-ordination of the proposed test on behalf of the <i>Registered Participant</i>. <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(c) The <i>Network Service Provider</i> must review the proposed test described in a notice provided under clause 5.7.5(a) to determine whether the test:</p> <ol style="list-style-type: none"> (1) could adversely affect the normal operation of the <i>power system</i>; (2) could cause a threat to <i>power system security</i>; (3) requires the <i>power system</i> to be operated in a particular way which differs from the way in which the <i>power system</i> is normally operated; or (4) could affect the normal metering of <i>energy</i> at a <i>connection point</i>. <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(d) If the <i>Network Service Provider</i> determines that the proposed test does fulfil one of the conditions specified in clause 5.7.5(c), then the <i>Registered Participant</i> and <i>Network Service Provider</i> must seek <i>AEMO's</i> approval prior to undertaking the test, which approval must not be unreasonably withheld or delayed.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	
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<p>(e) If, in <i>AEMO's</i> reasonable opinion, a test could threaten public safety, damage or threaten to damage equipment or adversely affect the operation of the <i>power system</i>, <i>AEMO</i> may direct that the proposed test procedure be modified or that the test not be conducted at the time proposed.</p> <p>(f) <i>AEMO</i> must advise <i>Network Service Providers</i> of any test which may have a possible effect on normal metering of <i>energy</i> at a <i>connection point</i>.</p> <p>(g) <i>AEMO</i> must advise any other <i>Registered Participants</i> who might be adversely affected by a proposed test and consider any reasonable requirements of those <i>Registered Participants</i> when approving the proposed test.</p> <p>(h) The <i>Registered Participant</i> who conducts a test under this clause 5.7.5 must ensure that the person responsible for the co-ordination of a test promptly advises <i>AEMO</i> when the test is complete.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(i) If <i>AEMO</i> approves a proposed test, <i>AEMO</i> must use its reasonable endeavours to ensure that <i>power system</i> conditions reasonably required for that test are provided as close as is reasonably practicable to the proposed start time of the test and continue for the proposed duration of the test.</p> <p>(j) Within a reasonable period after any such test has been conducted, the <i>Registered Participant</i> who has conducted a test under this clause 5.7.5 must provide the <i>Network Service Provider</i> with a report in relation to that test including test results where appropriate.</p>	
<p>5.7.6 Tests of generating units requiring changes to normal operation</p>	
<p>(a) A <i>Network Service Provider</i> may, at intervals of not less than 12 months per <i>generating system</i>, require the testing by a <i>Generator</i> of any <i>generating unit connected</i> to the <i>network</i> of that provider in order to determine analytic parameters for modelling purposes or to assess the performance of the relevant <i>generating unit</i> or <i>generating system</i> for the purposes of a <i>connection agreement</i>, and that provider is entitled to witness such tests.</p> <p>(b) If <i>AEMO</i> reasonably considers that:</p> <ol style="list-style-type: none"> (1) the analytic parameters for modelling of a <i>generating unit</i> or <i>generating system</i> are inadequate; or (2) available information, including results from a previous test of a <i>generating unit</i> or <i>generating system</i>, are inadequate to determine parameters for an applicable model developed in accordance with the <i>Power System Model Guidelines</i>, or otherwise agreed with <i>AEMO</i> under clause S5.2.4(c)(2), <p><i>AEMO</i> may direct a <i>Network Service Provider</i> to require a <i>Generator</i> to conduct a test under paragraph (a), and <i>AEMO</i> may witness such a test.</p> <p>(c) Adequate notice of not less than 15 <i>business days</i> must be given by the <i>Network Service Provider</i> to the <i>Generator</i> before the proposed date of a test under paragraph (a).</p>	<p>Procedures where NSP requires testing of generating systems that affect normal operations</p>

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<p>(d) The <i>Network Service Provider</i> must use its best endeavours to ensure that tests permitted under this clause 5.7.6 are conducted at a time which will minimise the departure from the <i>commitment</i> and <i>dispatch</i> that are due to take place at that time.</p> <p>(e) If not possible beforehand, a <i>Generator</i> must conduct a test under this clause 5.7.6 at the next scheduled <i>outage</i> of the relevant <i>generating unit</i> and in any event within 9 months of the request.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(f) A <i>Generator</i> must provide any reasonable assistance requested by the <i>Network Service Provider</i> in relation to the conduct of tests.</p> <p>(f1) If requested by a <i>Network Service Provider</i> who required the test under clause 5.7.6(a), a <i>Generator</i> must provide to the <i>Network Service Provider</i> any relevant information relating to the <i>plant</i> which is the subject of a test carried out under this clause 5.7.6, including model source code provided to <i>AEMO</i> under clause S5.2.4(b)(6).</p> <p>(g) Tests conducted under this clause 5.7.6 must be conducted in accordance with test procedures agreed between the <i>Network Service Provider</i> and the relevant <i>Generator</i> and a <i>Generator</i> must not unreasonably withhold its agreement to test procedures proposed for this purpose by the <i>Network Service Provider</i>.</p> <p>(h) A <i>Generator</i> must provide the test records obtained from a test under paragraph (a) to the <i>Network Service Provider</i>, who must derive the analytical parameters for the applicable model developed in accordance with the <i>Power System Model Guidelines</i>, or otherwise agreed with <i>AEMO</i> under clause S5.2.4(c)(2) and provide them and any new or revised model source code to the relevant <i>Generator</i>.</p> <p>(i) The <i>Generator</i>, the <i>Network Service Provider</i> and <i>AEMO</i> must each bear its own costs associated with tests conducted under this clause 5.7.6 and no compensation is to be payable for financial losses incurred as a result of these tests or associated activities.</p>	
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5.7.7 Inter-network power system tests

<p>(a) For each kind of development or activity described in the first column of chart 1 below, the <i>Proponent</i> is as set out in the second column and the <i>Relevant Transmission Network Service Provider (Relevant TNSP)</i> is as set out in the third column, respectively, opposite the description of the development or activity.</p> <p>Chart 1</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">No.</th> <th style="width: 30%;">Kind of development or activity</th> <th style="width: 30%;">Proponent</th> <th style="width: 35%;">Relevant TNSP</th> </tr> <tr> <th></th> <th>column 1</th> <th>column 2</th> <th>column 3</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">3.</td> <td>A new <i>generating unit</i> or <i>facility</i> of a <i>Customer</i> or a <i>network</i> development is commissioned that is anticipated to have a <i>material inter-network impact</i>.</td> <td>Generator in respect of the generating unit and associated connection assets. <i>Customer</i> in respect of the <i>facility</i> and associated <i>connection assets</i>.</td> <td>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.</td> </tr> </tbody> </table>	No.	Kind of development or activity	Proponent	Relevant TNSP		column 1	column 2	column 3	3.	A new <i>generating unit</i> or <i>facility</i> of a <i>Customer</i> or a <i>network</i> development is commissioned that is anticipated to have a <i>material inter-network impact</i> .	Generator in respect of the generating unit and associated connection assets. <i>Customer</i> in respect of the <i>facility</i> and associated <i>connection assets</i> .	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.	<p>Procedures around test that have inter-area (inter-regional) impacts.</p>
No.	Kind of development or activity	Proponent	Relevant TNSP										
	column 1	column 2	column 3										
3.	A new <i>generating unit</i> or <i>facility</i> of a <i>Customer</i> or a <i>network</i> development is commissioned that is anticipated to have a <i>material inter-network impact</i> .	Generator in respect of the generating unit and associated connection assets. <i>Customer</i> in respect of the <i>facility</i> and associated <i>connection assets</i> .	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.										

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		Network Service Provider in respect of the relevant network.		
4.	Setting changes are made to any <i>power system</i> stabilisers as a result of a <i>generating unit, facility</i> of a <i>Customer</i> or <i>network</i> development being commissioned, modified or replaced.	Generator in respect of the generating unit. <i>Customer</i> in respect of the <i>facility</i> . 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 <i>power system</i> stabilisers as a result of a decision by <i>AEMO</i> , which are not covered by item 4 in this chart.	AEMO.	None.	

(b) A *Registered Participant*, not being a *Transmission Network Service Provider*, determined in accordance with clause 5.7.7(a) to be a *Proponent* for a development or activity detailed in chart 1, may require the *Relevant TNSP* corresponding to that development or activity to undertake on their behalf their obligations as the *Proponent* and, where the *Relevant TNSP* receives a written request to undertake those obligations, the *Relevant TNSP* must do so.

(c) Where, in this clause 5.7.7, there is a reference to a *Proponent* that reference includes a *Relevant TNSP* required in accordance with clause 5.7.7(b) to undertake the obligations of another *Registered Participant*.

(d) If a *Relevant TNSP* is required by a *Registered Participant* in respect of a scheduled generating unit, a semi-scheduled generating unit, a scheduled load or a market network service, any of which have a nameplate rating in excess of 30 MW, to act as a *Proponent* in accordance with clause 5.7.7(b), that *Relevant TNSP* is entitled to recover all reasonable costs incurred from the *Registered Participant* that required the *Relevant TNSP* to act as the *Proponent*.

(e) A *Registered Participant* wishing to undertake a development or conduct an activity listed in item 1, 2, 3 or 4 of chart 1 must notify *AEMO* not less than 80 *business days* before the *transmission line, generating unit, facility* or *network* development is planned to be commissioned, modified or replaced, giving details of the development or activity.

(f) If *AEMO* receives a notice under clause 5.7.7(e), then it must provide a copy of the notice to each *jurisdictional planning representative* and consult with each *jurisdictional planning representative* about the potential impact of the development or activity.

(g) *AEMO* or the *Relevant TNSP* for a development or activity may notify the *Proponent* of the development or activity that *AEMO* or the *Relevant TNSP* believes an *inter-network test* is required for that development or activity.

(h) *AEMO* or the *Relevant TNSP* may only give a notice under clause 5.7.7(g) if:

(1) *AEMO* or the *Relevant TNSP* considers that the development or activity may have a material impact on the magnitude of the *power transfer capability* of more than one *transmission network* and, in the circumstances, an *inter-network test* is required;
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<p>(2) an <i>inter-network test</i> is required having regard to guidelines <i>published</i> under clause 5.7.7(k) and the surrounding circumstances.</p> <p>(i) If the <i>Relevant TNSP</i> gives a notice under clause 5.7.7(g), then it must also promptly give a copy of the notice to <i>AEMO</i>.</p> <p>(j) A <i>Registered Participant</i> undertaking a development or activity listed in chart 1 must provide information reasonably requested by <i>AEMO</i> or the <i>Relevant TNSP</i> for making an assessment under this clause.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(k) <i>AEMO</i> may develop, <i>publish</i> and amend from time to time, in accordance with the <i>Rules consultation procedures</i>, a set of guidelines to assist <i>Registered Participants</i> to determine when an <i>inter-network test</i> may be required.</p> <p>(l) <i>AEMO</i> and the <i>Relevant TNSP</i> must consider any relevant guidelines in determining whether an <i>inter-network test</i> is required.</p> <p>(m) If <i>AEMO</i> or the <i>Relevant TNSP</i> gives notice under clause 5.7.7(g), then the <i>Proponent</i> must, in consultation with <i>AEMO</i>, prepare a draft <i>test program</i> for the <i>inter-network test</i> and provide it to <i>AEMO</i>, each <i>jurisdictional planning representative</i> and the <i>Relevant TNSP</i> (if the <i>Relevant TNSP</i> gave the notice).</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(n) However, if <i>AEMO</i> determines that an <i>inter-network test</i> is required for a reason contemplated in item 5 or 6 of chart 1, then it must prepare a draft <i>test program</i> for the <i>inter-network test</i> in consultation with the <i>jurisdictional planning representatives</i> and provide that draft <i>test program</i> to each <i>jurisdictional planning representative</i>.</p> <p>(o) If a <i>jurisdictional planning representative</i> considers that any changes should be made to a draft <i>test program</i>, the <i>jurisdictional planning representative</i> must, within 10 <i>business days</i> after being provided with the draft <i>test program</i>, make a recommendation to <i>AEMO</i> that identifies the changes it proposes should be made to the draft <i>test program</i>.</p> <p>(p) <i>AEMO</i> must:</p> <ol style="list-style-type: none"> (1) <i>publish</i> a copy of the draft <i>test program</i> and any relevant changes recommended by any <i>jurisdictional planning representative</i> and invite interested <i>Registered Participants</i> to make written submissions; and (2) only accept as valid submissions received not later than the closing date for submissions specified in the notice <i>publishing</i> the copy of the draft <i>test program</i> (not to be less than 14 days after the date of <i>publication</i>); and (3) provide the <i>jurisdictional planning representatives</i> with copies of all valid submissions and seek any further recommendations they may have. <p>(q) <i>AEMO</i> must determine and <i>publish</i> in accordance with clause 3.13.13 the <i>test program</i> for an <i>inter-network test</i> after taking into account the recommendations of the <i>jurisdictional planning representatives</i> and any valid submissions received from <i>Registered Participants</i>.</p>	
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<p>(r) In determining the <i>test program</i>, AEMO must so far as practicable have regard to the following principles:</p> <ul style="list-style-type: none"> (1) <i>power system security</i> must be maintained in accordance with Chapter 4; and (2) the variation from the <i>central dispatch</i> outcomes that would otherwise occur if there were no <i>inter-network test</i> should be minimised; and (3) the duration of the tests should be as short as possible consistently with test requirements and <i>power system security</i>; and (4) the test facilitation costs to be borne by the <i>Proponent</i> under paragraph (aa) should be kept to the minimum consistent with this paragraph. <p>(t) An <i>inter-regional test</i> must not be conducted within 20 <i>business days</i> after AEMO publishes the <i>test program</i> for the <i>inter-network test</i> determined by AEMO under clause 5.7.7(r).</p> <p>(u) The <i>Proponent</i> in respect of an <i>inter-network test</i> must seek to enter into agreements with other <i>Registered Participants</i> to provide the test facilitation services identified in the <i>test program</i> in order to ensure that the <i>power system</i> conditions required by the <i>test program</i> are achieved.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(v) If the <i>Proponent</i> approaches another <i>Registered Participant</i> seeking to enter into an agreement under clause 5.7.7(u) then the <i>Proponent</i> and the <i>Registered Participant</i> must negotiate in good faith concerning the provision of the relevant test facilitation service.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(w) If:</p> <ul style="list-style-type: none"> (1) a <i>Proponent</i> approaches another <i>Registered Participant</i> as described in clause 5.7.7(v); and (2) the <i>Proponent</i> and the other <i>Registered Participant</i> have not agreed the terms and conditions to be included in the agreement under which the <i>Registered Participant</i> will provide the test facilitation service requested within 15 <i>business days</i> of the approach, <p>then those terms and conditions must be determined in accordance with rule 8.2 and a dispute of this type is deemed to fall within clause 8.2.5(c)(2).</p> <p>(x) If the dispute concerns the price which the <i>Proponent</i> is to pay for a test facilitation service, then it must be resolved applying the following principles:</p> <ul style="list-style-type: none"> (1) the other <i>Registered Participant</i> is entitled to recover the costs it incurs, and a reasonable rate of return on the capital it employs, in providing the test facilitation service, determined taking into account the additional costs associated with: 	
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<p>(i) maintaining the equipment necessary to provide the test facilitation service;</p> <p>(ii) any labour required to operate and maintain the equipment used to provide the test facilitation service; and</p> <p>(iii) any materials consumed when the test facilitation service is utilised; and</p> <p>(2) the other <i>Registered Participant</i> is entitled to be compensated for any commercial opportunities foregone by providing the test facilitation service.</p> <p>(y) When the terms and conditions are determined in accordance with rule 8.2 under this clause 5.7.7, then the <i>Proponent</i> and the other <i>Registered Participant</i> must enter into an agreement setting out those terms and conditions.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(z) If <i>AEMO</i> is not the <i>Proponent</i> in respect of an <i>inter-network test</i>, the <i>Proponent</i> must:</p> <p>(1) prior to the scheduled date of the <i>inter-network test</i>, confirm to <i>AEMO</i> that the test facilitation services identified in the <i>test program</i> will be available to be utilised, who will be providing them and the operational arrangements for utilising them;</p> <p>(2) provide sufficient information to enable <i>AEMO</i> to utilise the test facilitation services in conducting the <i>inter-network test</i>; and</p> <p>(3) respond promptly to any queries <i>AEMO</i> raises with the <i>Proponent</i> concerning the availability of the test facilitation services and <i>AEMO's</i> ability to utilise those services in conducting the <i>inter-network tests</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(aa) The <i>Proponent</i> in respect of an <i>inter-network test</i> must bear all of the following costs associated with that <i>inter-network test</i>:</p> <p>(1) any amounts payable under an agreement under which test facilitation services are provided;</p> <p>(2) the <i>Proponent's</i> own costs associated with the <i>inter-network test</i> and in negotiating and administering the agreements referred to in clause 5.7.7(u); and</p> <p>(3) if the <i>Proponent</i> is not <i>AEMO</i> and the amount of <i>settlements residue</i> on any <i>directional interconnector</i> for a <i>trading interval</i> during which there is an impact on <i>central dispatch</i> outcomes as a result of the <i>inter-network test</i> is negative, then the <i>Proponent</i> must enter into an agreement with <i>AEMO</i> to pay that amount to <i>AEMO</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 2 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>...</p>	
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<p>(ac) <i>AEMO</i> must establish operational conditions to achieve the particular <i>power transfer</i> levels for each stage of the <i>inter-network test</i> as contemplated by the <i>test program</i>:</p> <ol style="list-style-type: none"> (1) utilizing where practicable and economic to do so the test facilitation services identified in the <i>test program</i>; and (2) otherwise, by applying to the minimum extent necessary to fulfil the test requirements, <i>inter-network testing constraints</i>. <p>(ad) An <i>inter-network test</i> must be coordinated by an officer nominated by <i>AEMO</i> who has authority to stop the test or any part of it or vary the procedure within pre-approved guidelines determined by <i>AEMO</i> if that officer considers any of these actions to be reasonably necessary.</p> <p>(ae) Each Registered Participant must:</p> <ol style="list-style-type: none"> (1) cooperate with <i>AEMO</i> in planning, preparing for and conducting <i>inter-regional</i> tests; (2) act in good faith in respect of, and not unreasonably delay, an <i>inter-network test</i>; and (3) comply with any instructions given to it by <i>AEMO</i> under clause 5.7.7(af). <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>...</p>	
<p>5.8 Commissioning</p>	
<p>5.8.1 Requirement to inspect and test equipment</p>	
<p>(a) A <i>Registered Participant</i> must ensure that any of its new or replacement equipment is inspected and tested to demonstrate that it complies with relevant <i>Australian Standards</i>, the <i>Rules</i> and any relevant <i>connection agreement</i> prior to or within an agreed time after being <i>connected</i> to a <i>transmission network</i> or <i>distribution network</i>, and the relevant <i>Network Service Provider</i> is entitled to witness such inspections and tests.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p> <p>(b) The <i>Registered Participant</i> must produce test certificates on demand by the relevant <i>Network Service Provider</i> showing that the equipment has passed the tests and complies with the standards set out in clause 5.8.1(a) before <i>connection</i> to a <i>network</i>, or within an agreed time thereafter.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	<p>All new and replacement equipment must be inspected and tested according to relevant standards prior to being connected to a network.</p> <p>An NSP can request to witness tests, see test certificates.</p>
<p>5.8.2 Co-ordination during commissioning</p>	

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<p>A <i>Registered Participant</i> seeking to connect to a network must co-operate with the relevant <i>Network Service Provider(s)</i> and <i>AEMO</i> to develop procedures to ensure that the commissioning of the <i>connection</i> and <i>connected facility</i> is carried out in a manner that:</p> <ul style="list-style-type: none"> (a) does not adversely affect other <i>Registered Participants</i> or affect <i>power system security</i> or quality of <i>supply</i> of the <i>power system</i>; and (b) minimises the threat of damage to any other <i>Registered Participant's</i> equipment. 	<p>A Generator must cooperate with NSP and AEMO to ensure that commissioning and connection activities do not affect power system security, quality of supply.</p>
<p>5.8.3 Control and protection settings for equipment</p>	
<ul style="list-style-type: none"> (a) Not less than 3 months prior to the proposed commencement of commissioning by a <i>Registered Participant</i> of any new or replacement equipment that could reasonably be expected to alter performance of the <i>power system</i> (other than replacement by identical equipment), the <i>Registered Participant</i> must submit to the relevant <i>Network Service Provider</i> sufficient design information including proposed parameter settings to allow critical assessment including analytical modelling of the effect of the new or replacement equipment on the performance of the <i>power system</i>. Note This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.) (b) The <i>Network Service Provider</i> must: <ul style="list-style-type: none"> (1) consult with other <i>Registered Participants</i> and <i>AEMO</i> as appropriate; and (2) within 20 <i>business days</i> of receipt of the design information under clause 5.8.3(a), notify the <i>Registered Participant</i> and <i>AEMO</i> of any comments on the proposed parameter settings for the new or replacement equipment. Note This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.) (c) If the <i>Network Service Provider's</i> comments include alternative parameter settings for the new or replacement equipment, then the <i>Registered Participant</i> must notify the <i>Network Service Provider</i> that it either accepts or disagrees with the alternative parameter settings suggested by the <i>Network Service Provider</i>. (d) The <i>Network Service Provider</i> and the <i>Registered Participant</i> must negotiate parameter settings that are acceptable to them both and if there is any unresolved disagreement between them, the matter must be referred to <i>AEMO</i> whose decision must be given within 20 <i>business days</i> of referral of the dispute and, once a decision is given, it is to be final. (e) The <i>Registered Participant</i> and the <i>Network Service Provider</i> must co-operate with each other to ensure that adequate grading of protection is achieved so that faults within the <i>Registered Participant's facility</i> are cleared without adverse effects on the <i>power system</i>. 	<p>The Generator must provide control and protection designs/settings to an NSP for review and analysis prior to commissioning.</p>
<p>5.8.4 Commissioning program</p>	
<ul style="list-style-type: none"> (a) Prior to the proposed commencement of commissioning by a <i>Registered Participant</i> of any new or replacement equipment that could reasonably be expected to alter performance of the <i>power system</i>, the <i>Registered Participant</i> must advise the relevant <i>Network Service</i> 	<p>A Generator is required to prepare and provide to NSP</p>

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<p><i>Provider</i> and <i>AEMO</i> in writing of the commissioning program including test procedures and proposed test equipment to be used in the commissioning.</p> <p>(b) Notice under clause 5.8.4(a) must be given not less than 3 months prior to commencement of commissioning for a <i>connection</i> to a <i>transmission network</i> and not less than 1 month prior to commencement of commissioning for a <i>connection</i> to a <i>distribution network</i>.</p> <p>(c) The relevant <i>Network Service Provider</i> and <i>AEMO</i> must, within 15 <i>business days</i> of receipt of such advice under clause 5.8.4(a), notify the <i>Registered Participant</i> either that they:</p> <ol style="list-style-type: none"> (1) agree with the proposed commissioning program; or (2) require changes to it in the interest of maintaining <i>power system security</i>, safety or quality of <i>supply</i>. <p>(d) If the relevant <i>Network Service Provider</i> or <i>AEMO</i> require changes to the proposed commissioning program, then the parties must co-operate to reach agreement and finalise the commissioning program within a reasonable period.</p> <p>(e) A <i>Registered Participant</i> must not commence the commissioning until the commissioning program has been finalised and the relevant <i>Network Service Provider</i> and <i>AEMO</i> must not unreasonably delay finalising a commissioning program.</p>	<p>and <i>AEMO</i> a commissioning program, including test procedures.</p> <p>NSP and <i>AEMO</i> review and inform within 15 business days whether they agree or require changes. The review is based on maintaining power system security, safety, quality of supply or impact to others.</p> <p>Requirement for parties to cooperate to resolve within a reasonable time. Generator cannot commence commissioning without agreement, which must not be unreasonably delayed.</p>
<p>5.8.5 Commissioning tests</p>	
<p>(a) The relevant <i>Network Service Provider</i> and/or <i>AEMO</i> has the right to witness commissioning tests relating to new or replacement equipment that could reasonably be expected to alter performance of the <i>power system</i> or the accurate metering of <i>energy</i>.</p> <p>(b) The relevant <i>Network Service Provider</i> must, within a reasonable period of receiving advice of commissioning tests, notify the <i>Registered Participant</i> new or replacement equipment is to be tested under this clause 5.8.5 whether or not it:</p> <ol style="list-style-type: none"> (1) wishes to witness the commissioning tests; and (2) agrees with the proposed commissioning times. <p>(c) A <i>Registered Participant</i> whose new or replacement equipment is tested under this clause 5.8.5 must submit to the relevant <i>Network Service Provider</i> the commissioning test results demonstrating that a new or replacement item of equipment complies with the <i>Rules</i> or the relevant <i>connection agreement</i> or both to the satisfaction of the relevant <i>Network Service Provider</i>.</p> <p>Note</p> <p>This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)</p>	<p>Rights for NSP and <i>AEMO</i> to witness commissioning and testing.</p> <p>NSP must advise the Generator within a reasonable period of time whether witnessing will take place, and whether the timing of tests is accepted.</p> <p>Requirement for Generator to provide results to NSP proving the plant or equipment complies with the <i>Rules</i> or connection agreement.</p>

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<p>(d) If the commissioning tests conducted in relation to a new or replacement item of equipment demonstrates non-compliance with one or more requirements of the <i>Rules</i> or the relevant <i>connection agreement</i> then the <i>Registered Participant</i> whose new or replacement equipment was tested under this clause 5.8.5 must promptly meet with the <i>Network Service Provider</i> to agree on a process aimed at achievement of compliance of the relevant item with the <i>Rules</i>.</p> <p>(e) On request by a <i>Network Service Provider</i>, <i>AEMO</i> may direct that the commissioning and subsequent <i>connection</i> of the <i>Registered Participant's</i> equipment must not proceed if the relevant equipment does not comply with the requirements described in clause 5.8.1(a).</p>	<p>If the testing shows non-compliance, the Generator and NSP must meet and discuss how compliance will be achieved. NSP may request that AEMO halts testing if it is demonstrated that the requirements of 5.8.1(a) are not met.</p>
<p>S5.2.2 Application of Settings</p>	
<p>A <i>Generator</i> must only apply settings to a <i>control system</i> or a <i>protection system</i> that are necessary to comply with performance requirements of this schedule 5.2 if the settings have been approved in writing by the relevant <i>Network Service Provider</i> and, if the requirement is one that would involve <i>AEMO</i> under clause 5.3.4A(c) of the <i>Rules</i>, also by <i>AEMO</i>. A <i>Generator</i> must not allow its <i>generating unit</i> to supply electricity to the <i>power system</i> without such prior approval.</p> <p>If a <i>Generator</i> seeks approval from the <i>Network Service Provider</i> to apply or change a setting, then (except in the case of settings to be applied or changed by the <i>Generator</i> in connection with an <i>emergency frequency control scheme</i>) approval must not be withheld unless the <i>Network Service Provider</i> or, if the requirement is one that would involve <i>AEMO</i> under clause 5.3.4A(c) of the <i>Rules</i>, <i>AEMO</i>, reasonably determines that the changed setting would cause the <i>generating unit</i> to not comply with the relevant <i>performance standard</i> or cause an <i>inter-regional</i> or <i>intra-regional power transfer capability</i> to be reduced.</p> <p>If the <i>Network Service Provider</i> or, if the requirement is one that would involve <i>AEMO</i> under clause 5.3.4A(c) of the <i>Rules</i>, <i>AEMO</i>, reasonably determines that a setting of a <i>generating unit's control system</i> or <i>protection system</i> needs to change to comply with the relevant <i>performance standard</i> or to maintain or restore an <i>inter-regional</i> or <i>intra-regional power transfer capability</i>, the <i>Network Service Provider</i> or <i>AEMO</i> (as applicable) must consult with the relevant <i>Generator</i>, and the <i>Network Service Provider</i> may request in writing that a setting be applied in accordance with the determination.</p> <p>The <i>Network Service Provider</i> may also request a test to verify the performance of the relevant <i>plant</i> with the new setting. The <i>Network Service Provider</i> must provide <i>AEMO</i> with a copy of its request to a <i>Generator</i> to apply a setting or to conduct a test.</p> <p>A <i>Generator</i> who receives such a request must arrange for the notified setting to be applied as requested and for a test to be conducted as requested. After the test, the <i>Generator</i> must, on request, provide both <i>AEMO</i> and the <i>Network Service Provider</i> with a report of a requested test, including evidence of its success or failure. Such a report of a test is <i>confidential information</i>.</p> <p>A <i>Generator</i> must not change a setting requested by the <i>Network Service Provider</i> without its prior written agreement. If the <i>Network Service Provider</i> requires a <i>Generator</i> to change a setting within 18 months of a previous request, the <i>Network Service Provider</i> must pay the <i>Generator</i> its reasonable costs of changing the setting and conducting the tests as requested.</p>	<p>Allow a testing requirement following approved setting changes.</p>
<p>S5.2.4 Provision of information</p>	

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<p>(d) The <i>Generator</i> must provide to <i>AEMO</i> information that updates the information provided under clause S5.2.4(b) and must provide to the relevant <i>Network Service Providers</i> information that updates the information provided under clause S5.2.4(b)(5):</p> <ol style="list-style-type: none"> (1) within 3 months after commissioning tests or other tests undertaken in accordance with clause 5.7.3 are completed; (2) when the <i>Generator</i> becomes aware that the information is incomplete, inaccurate or out of date; or (3) on request by <i>AEMO</i> or the relevant <i>Network Service Provider</i>, where <i>AEMO</i> or the relevant <i>Network Service Provider</i> considers that the information is incomplete, inaccurate or out of date. 	<p>Within 3 months following completion of commissioning tests, the <i>Generator</i> must provide <i>AEMO</i> with updated information (data and models).</p>
<p>S5.5.2 Categories of data</p>	
<p>Registered data</p> <p>Registered Data consists of data validated and agreed between the <i>Network Service Provider</i> and the <i>Registered Participant</i>, such data being:</p> <ol style="list-style-type: none"> (a) prior to actual <i>connection</i> and provision of access, data derived from manufacturers' data, detailed design calculations, works or site tests etc. (R1); and (b) after connection, data derived from on-system testing (R2). <p>All of the data will, from this stage, be categorised and referred to as Registered Data; but for convenience the schedules omit placing a higher ranked code next to items which are expected to already be valid at an earlier stage.</p>	<p>Notes that data/information/models will be updated as a plant progresses from concept</p>
<p>8.8 Reliability Panel</p>	
<p>8.8.1 Purpose of Reliability Panel</p>	
<p>(a) The functions of the <i>Reliability Panel</i> are to:</p> <p>...</p> <p>(2B) determine, and modify as necessary, and <i>publish</i> the <i>template for generator compliance programs</i>; ...</p>	<p>Reliability Panel must develop template for Generator Compliance programs</p>
<p>8.8.3 Reliability Panel review process</p>	
<p>As soon as practicable, the <i>Reliability Panel</i> must determine:</p> <p>...</p> <p>(6) the template for generator compliance programs, in accordance with this clause 8.8.3.</p>	<p>The template for generator compliance programs is to be reviewed at least every 5 years.</p>
<p>(ba) At least every 5 years from the date the <i>template for generator compliance programs</i> is determined pursuant to clause 8.8.3(a) and at such other times as the <i>AEMC</i> may request, the <i>Reliability Panel</i> must conduct a review of the <i>template for generator compliance programs</i> in accordance with this clause 8.8.3. Following such a review, the <i>Reliability Panel</i> may amend the <i>template for generator compliance programs</i> in accordance with its report to the <i>AEMC</i> submitted under clause 8.8.3(j).</p>	

<p>Chapter 10 - Glossary</p>	
<p><i>template for generator compliance programs</i></p> <p>The template determined and published by the Reliability Panel under clause 8.8.3 of the Rules.</p>	
<p>test program</p> <p>In respect of an <i>inter-network test</i> or a <i>system restart test</i>, means the program and co-ordination arrangements for the test including (without limitation):</p> <ol style="list-style-type: none"> (1) test procedures; (2) the proposed timing of the test; (3) operating procedures to manage <i>power system security</i> during the test; (4) required <i>power system</i> conditions for conducting the test; (5) for an <i>inter-network test</i>, test facilitation services including, as necessary, <i>ancillary services</i> required to achieve those <i>power system</i> conditions; (6) criteria for continuing or concluding a test and the decision-making process relevant to the test; and (7) contingency arrangements. 	

APPENDIX C EXCERPT FROM THE TEMPLATE FOR GENERATOR COMPLIANCE PROGRAMS

1.2 Compliance principles

The Panel used the following compliance principles in developing its template. These principles should also be considered by generators in developing and modifying their compliance programs.

Principle 1:	Where plant system performance may be variable with time, as for example with plant protection, control and alarm (PCA) systems, <i>Generators</i> are accountable for managing the functionality and integrity of systems and settings in accordance with the performance standards compliance program.
Principle 2:	The corollary of the Principle #1 is that where plant parameters are not subject to variability with time, the compliance regime should be restricted to confirmation that the plant continues to perform as intended with repeat testing when there are reasonable grounds to believe that the plant performance may have changed.
Principle 3:	The materiality of the issue must be considered when contemplating a compliance testing regime.
Principle 4:	A <i>Generator's</i> active use and implementation of a compliance program that is consistent with the approved template and the Generator's compliance management framework will provide a reasonable assurance of compliance with the Generator's registered performance standards.
Principle 5:	The template must therefore support the development of compliance programs which represent "good electricity industry practice". The template should specify the objectives and outcomes to be achieved by the testing or monitoring, and an appropriate test interval. The <i>Generator</i> should exercise diligence and good electricity industry practice to determine the detailed methods and procedures to be employed for its plant.
Principle 6:	The compliance testing regime must be efficient, and reflect an equitable balance between risk management and the risk created by the test regime itself.
Principle 7:	Where appropriate, analysis of performance during an event or disturbance could be used to demonstrate compliance in lieu of a performance test.
Principle 8:	Where compliance to a performance standard cannot be directly tested, the compliance program should include a range of other compliance testing methods to provide reasonable assurance that the performance standard continues to be met.
Principle 9:	When developing a compliance program and operating under that program, a <i>Generator</i> can only be reasonably held accountable for the compliance of its plant to its registered performance standards and to equipment settings approved or provided by AEMO and/or the transmission network service provider (TNSP).
Principle 10:	Compliance programs should be reviewed and updated periodically.

APPENDIX D EXCERPT FROM AEMO'S COMMISSIONING REQUIREMENTS FOR GENERATING SYSTEMS

The below paragraphs are provided as examples of useful content from the above-mentioned document. As these are only excerpts, the full document needs to be read for context.

2 AEMO's Roles in Commissioning

AEMO's roles in relation to commissioning include:

- operator of the power system and responsible for power system security across the NEM;
- operator of the electricity trading market; and
- provider of declared network functions in specified jurisdictions.

As the system operator, AEMO becomes involved in the commissioning of all new registered plant connected to the distribution network, and all new plant connected to the transmission network. In all states, AEMO reviews commissioning tests to ensure power system security is maintained. In these circumstances, AEMO consults with the relevant NSP to ensure that the generating system complies with the Registered Performance Standards through the commissioning process. Commissioning tests are undertaken to demonstrate the generating system meets the Registered Performance Standards, and to provide sufficient information to allow the generating system to remain online without direct supervision.

...

5 Principles

The commissioning of new or upgraded plant that interacts with the power system is an essential stage in the process of implementing a new connection. AEMO applies the same principles for the commissioning of all generating systems, regardless of technology type. The commissioning process is directly managed by the registered participant and the relevant NSP, generally in consultation with AEMO. As the first stage of the commissioning process, the applicant must develop a commissioning plan and submit the plan to the relevant NSP and AEMO.

...

The overall approach to commissioning is outlined in Clause 5.8 of the Rules. In particular, the generator is required to cooperate with the relevant NSP and AEMO to ensure that commissioning is undertaken in a manner that:

- does not adversely affect other registered participants;
- does not affect power system security or quality of supply; and
- minimises the risk of damage to the equipment of other registered participants.

The applicant is responsible for specifying and undertaking commissioning tests and providing evidence to AEMO and the relevant NSP that demonstrates the performance of the plant. The commissioning tests of interest to AEMO are considered a part of the overall commissioning activities, with AEMO expecting that the applicant would have additional commissioning requirements.

APPENDIX E KEY THEMES, ISSUES AND RECOMMENDATIONS

Theme	Issue	Recommendation
Resourcing	Stakeholders value single point of contact technical engagement – background understanding of plant increases the efficiency in anticipating, identifying or resolving issues	Promote long-term engagement from AEMO Connection team – prefer single resource or if there is staff turn-over, well managed sharing/hand-over. Build experience and cooperation on a project via a consistent team throughout the duration of a project – application to commissioning and compliance testing.
Communication	Clear concise and relevant communication between parties to optimise resource usage.	Agree specific communication channels to quickly manage unforeseen issues arising during the testing. Mapped paths for issue definition and resolution.
Efficient, Fit-for-purpose processes	Resources need to be used effectively and efficiently. Testing needs to achieve a clear outcome not ‘tick a box’ approach. Ensure that risks to power system security and orderly market operations are balanced against risks associated with testing.	Adopt a principles-based approach to developing testing and commissioning plans (with reference to those in the AEMC Reliability Panel Template for Generator Compliance Programs). Encourage enduring active compliance culture – referencing Template for Generator Compliance Programs. Review hold point test framework – - differentiate needs for stability checks vs compliance checks - only necessary tests at each stage - focussed reporting - overlays and model validation used as appropriate.
Flexibility and consistency	There is a clear desire for consistency, but not at the cost of flexibility – achieving a balance between these naturally opposing objectives is challenging.	Adopt a framework for establishing test methodologies. Ensure that alternative approaches can be adopted to suit the risk profile and outcomes. Particularly consider impact of energy source availability; plant capacity and its relative network impact.
Transparency	Understanding objectives, responsibility and risk for each participant.	Engage openly and respectfully – communicate specific risk vectors to ensure balanced and equitable risk management. Encourage witness testing (online/virtual).

<p>Secure processes (avoid near-misses)</p>	<p>Testing and commissioning practices should not add to power system security risk, must minimise risk of “near-miss” events.</p>	<p>Upskill personnel across industry via below activities.</p> <ol style="list-style-type: none"> 1. Review past compliance matters, near-miss events, with a culture of sharing knowledge and lessons-learned. Educate and inform – internally and externally. 2. Avoid unnecessary operational changes – control system, setting, firmware. Use a risk management approach to measure value against risk. 3. Adopt practices to encourage “designing out” risk factors instead of taking a “test-out” approach.
<p>NER</p>	<p>Limited reference to or reliance on the NER, limited understanding of obligations and responsibilities.</p>	<p>Guidelines to make direct reference to NER obligations.</p> <p>Improve communications and education internally and externally.</p> <p>Utilise existing NER referenced resources:</p> <ul style="list-style-type: none"> - Template for Generator Compliance - NER mandated information resources - Power System Operating procedures - Guidelines

APPENDIX F RECOMMENDED TEST OUTLINE

The below table represents a recommended revised hold point test schedule.

The suggested number of hold points is 3. In some circumstances, such as smaller facilities, fewer hold points should be considered. In other circumstances additional hold points may be appropriate – based on specific risks.

Note that the suggested test plan assumed that voltage droop control is the primary form of voltage/reactive power control. Where alternative modes (PF or Q control) are the primary control mode, then the test plan should be adjusted to reflect this.

Note that measures to manage and resolve issues identified during the hold point testing process will need to be outlined alongside the plan to progress from one testing level to the next. Where operation at lower hold point levels is not stable, nor correct, the reasons for this need to be investigated and understood. Referencing the non-compliance process, assessing and understanding the risks associated with the observed behaviour will facilitate developing an appropriate progression strategy.

	HP0	HP1	HP2	HP3	COMMENT
Objective	Commissioning and testing of equipment without generation	Check correct and stable operation	Check correct and stable operation	Check correct and stable operation. Confirm GPS compliance. Collect data to be used in R2 model validation.	Generator may elect to conduct additional activities at each level. Additional tests, model checks may be an element in their contractual arrangement or risk management strategy.
Power quality	Background power quality measurements	Power quality monitoring	Power quality monitoring	Power quality test	
Commissioning and Energisation	Protection system	Commissioning tests/checks for any equipment not energised for previous hold points			
	Transformer				Including tap changer testing.
	SCADA systems				Including internal and external systems/signals and controls.
	Control systems				Including receipt of AGC and VDS signals. Including logic tests - auxiliary plant switching, run-back scheme logic etc.

– ROLES AND RESPONSIBILITIES

	HP0	HP1	HP2	HP3	COMMENT
	Synchronous dynamic reactive and/or system strength support device control				If installed/applicable.
	Reactive support/filter equipment				If installed/applicable. Include voltage control test – systems that operate independently of generating system - e.g. night-time filter bank switching, Vref tests for DVAR systems etc.
	Generating unit signal injection tests				May be done off-site where secondary injection not possible - using site-specific settings.
	End to end communication delay check				Note this may require repetition at HP level with additional plant online.
Active power control tests		Generating system active power control test (local control)			Plant will run and participate in dispatch from commencement of HP testing. Should remain in auto mode.
		Generating system active power control (automatic dispatch)*	Generating system active power control (automatic dispatch)	Generating system active power control (automatic dispatch)	Plant will run and participate in dispatch from commencement of HP testing. Should remain in auto mode. * For semi-scheduled facilities, confirm plant responds to semi-dispatch cap correctly (HP1).
		Active power step test	Active power step test	Active power step test	
		Generating system frequency response		Generating system frequency response and control test	By observation at HP1 - response to normal system variations.

– ROLES AND RESPONSIBILITIES

Primary control mode tests (voltage control or reactive power control) tests**	** The below tests are based on a site with voltage droop control implemented as primary. For sites with PF or Q control adjust accordingly.			
	Generating system voltage reference step test (local)	Generating system voltage reference step test	Generating system voltage reference step test	HP2 and HP3 may be via local or VDS. Suggest local due to unknown/uncontrolled timing for VDS system.
	Generating system voltage reference step test (VDS)			If applicable to site. VDS control to be tested as soon as available and plant run in auto mode once implemented.
	Generating system reactive power capability test and limiter testing (via voltage reference step test)	Generating system reactive power capability test and limiter testing (via voltage reference step test)	Generating system reactive power capability test and limiter testing (via voltage reference step test)	Reactive power capability and limiter operation to be demonstrated via applying Vref to limits
	Capacitor manual switching test (if capacitor/filter available)	Capacitor manual switching test (if capacitor/filter available)	Capacitor manual switching test (if capacitor/filter available)	Reactive device or other switching (internal or external) may be applied to demonstrate stable response to external system events for both active and reactive power control systems.
Secondary control mode tests	Generating system communication fail test			Test to be consistent with the communication system design, perform once at any relevant HP.
			Generating system reactive power reference test	If applicable.
			Generating system power factor reference step test	If applicable.

- ROLES AND RESPONSIBILITIES

<p>Observations</p>		<p>Start up/shut down</p>			<p>Solar farm daily cycle – including start-up, shut-down and any 'Q-at-night' performance (if applicable).</p> <p>Wind farm - low wind/high wind performance.</p> <p>Synchronous facility - commitment and run-up to minimum loading.</p>
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