



Process Review of NER Rule 5.3.9 Application

Recommendations Report

November 2023



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Authors	Nathan Potter, Sam Morton and Jezac Crowe	8/12/23
Reviewers	Scott Connel	8/12/23

Prepared for AEMO  
 Prepared by Clutch Strategic  
 T +61 437 113 034  
[www.clutch.com.au](http://www.clutch.com.au)

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# Abbreviations

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Abbreviation	Meaning
AAS	Automatic Access Standards
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
BESS	Battery Energy Storage System
CEC	Clean Energy Council
CRI	Connections Reform Initiative
FIA	Full Impact Assessment
GAFG	Generator Alteration Framework Guide
GPS	Generator Performance Standards
MAS	Minimum Access Standards
NAS	Negotiated Access Standard
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Providers
OEM	Original Equipment Manufacturer
POC	Point of Connection
PSCAD	Power Systems Computer Aided Design
PSMG	Power System Model Guidelines
TNSP	Transmission Network Service Providers
TWG	Technical Working Group

# 1 Executive Summary

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## 1.1 Introduction

This report has been commissioned as part of the broader Connections Reform Initiative (CRI); a joint program of the Australian Energy Market Operator (AEMO) and the Clean Energy Council (CEC).

The CRI is tasked to lead the development of solutions to the most pressing concerns affecting the National Electricity Market (NEM) generator connections process.

The national electricity grid is undergoing a period of significant change, driven largely by the number and scale of renewable energy systems joining the grid, while at the same time traditional generator sources, such as coal fired generation, are being retired.

The generator connection process requires modernisation to ensure that new generation can be connected in a timely and cost-effective manner, while equally enabling the energy system to become responsive to the evolution of generation technology and capability, now and into the future.

## 1.2 National Electricity Rules

The National Electricity Rules (NER) provide the regulatory framework and processes necessary for the national electricity system to function, including the process for network connections and access.

NER 5.3 deals with *Establishing or Modifying a Connection*, while NER 5.3.9 further defines the *Procedure to be followed by a Generator proposing to alter a generating system*. Through the CRI, an effective generator alteration mechanism was identified as being significant to the success of modernising the connection process.

This report has investigated how the interpretation and application of NER 5.3.9 is impacting the national electricity market, and to provide recommendations to improve the application of the NER 5.3.9 process.

## 1.3 Review Process

This review was undertaken with the aim to provide AEMO, Network Service Providers (NSP) and electricity Generators (addressed in this report as Proponents) with actionable recommendations and a clear and workable path to meeting the aims of the CRI.

Clutch Pty Ltd (Clutch) was appointed by AEMO to lead this review. Clutch has broad experience and insights of the connection process, having consulted and supported proponents and NSPs in the NER 5.3.9 application on numerous occasions. In the conduct of this review, Clutch has independently applied their own expertise, experience, and judgement to shape the final recommendations and balance the needs and priorities of all stakeholders.

The review was conducted over three phases:

- Phase 1: A literature review of publicly available documents regarding NER 5.3.9 and an internal assessment by Clutch of the NER 5.3.9 background, process, and limitations.
- Phase 2: A series of six facilitated workshops with members of the Technical Working Group (TWG). These workshops aimed to understand the critical issues with the current NER 5.3.9 process and the impacts these issues are having on the industry, as well as to explore potential ideas for solutions to the key issues identified.
- Phase 3: Recommendations and report drafting.

## 1.4 Key Finding

The key finding of this review is that NER 5.3.9, as written, invites broad and divergent interpretations on its intention and application.

NER 5.3.9 has been found to contain ambiguities in application, intent and roles and responsibilities. Furthermore, NER sub-clauses limit decision makers ability to apply discretion to approve what would otherwise be alterations which would deliver net-benefits to the power system.

Under the current status quo, the NER 5.3.9 process will continue to impact the efficient implementation of generator alterations, deterring generation investment and slowing the modernisation of Australia's generation fleet, inhibiting the energy transition.

This key finding is underpinned by six key issues, which were distilled from the TWG workshops:

1. Proponents, NSPs and AEMO each have inconsistent views on when, where and how NER 5.3.9 is applied.
2. There is a lack of information to support Proponents to understand and correctly apply NER 5.3.9 to their operations.
3. The performance standard requirements imposed under NER 5.3.9, via parts of NER 5.3.4, limit the opportunity for alterations which may provide a 'net benefit' to the power system.
4. There is uncertainty as to the scope and application of NER 5.3.9 when making alterations to legacy plant.
5. There is uncertainty as to how NER 5.3.9 is to be applied to the retrofit of Battery Energy Storage System (BESS) into, or the creation of hybrid systems within, existing connections.
6. Proponents, NSPs and AEMO are unclear on the roles and responsibilities they have in regard to NER 5.3.9

The industry engagement relating to this review identified examples of proponents shelving positive investment plans, based on their interpretation of NER 5.3.9. In these examples proponents considered that the ambiguities of the NER 5.3.9 process carried unacceptable financial and investment risk to their operations, and so the alteration was not pursued.

## 1.5 Recommendations

The NER 5.3.9 process is negatively impacting the modernisation of the national electricity grid. Based on the issues and findings identified by this review, the following recommendations are made:

There are five recommendations.

1. AEMO provide increased clarity of the intent of NER 5.3.9, which is then applied across all subsequent recommendations.

*By clearly setting out the principles of intent, this recommendation will provide industry with greater clarity on the application and intent of NER 5.3.9 and will improve clarity and consistency of application.*

2. AEMO develop a Generator Alteration Framework.

*This will be a comprehensive suite of guidance and tools to support proponents through the generator alteration process, improving proponent education and understanding and resulting in greater consistency of NER 5.3.9 application by ensuring alignment between different alteration scenarios and alteration process appropriate to each. This recommendation will also give effect to the intent and principles from Recommendation 1.*

3. Submit a rule change proposal seeking to amend NER 5.3.4 where it limits the intent of NER 5.3.9. This rule change proposal should seek to:

- Remove requirement for a Negotiated Access Standard (NAS) to be as close as possible to the AAS per NER 5.3.4A(b1), when considering an NER 5.3.9 alteration.
- Remove requirement in NER 5.3.4A(b)(1A) which prohibits any reduction in a performance standard, when considering an NER 5.3.9 alteration.
- Ensure altered performance is no less onerous than the lower of the MAS which existed at the time the generator first established it GPS, and the existing agreed level of performance.

*These amendments will enable NSPs to exercise discretion and enable Proponents to pursue alterations where there may be an impact to some part of the access standard, but that the alteration would not have an adverse impact on the system.*



- On conclusion of the rule change initiated under the CEC ‘Enhancing investment certainty in the R1 process’; AEMO conduct a review of the how that change has affected the treatment of alterations, where NER 5.3.9 applies, between NER 5.3.4A approval and R2.

*This will ensure that the necessary treatments identified in this review are sufficient to deal with alterations between NER 5.3.4A approval and R2 and align with the proposed improvement in the CEC’s proposal.*

- AEMO contact all facilities where plant modelling is understood to be simplified, or a representative facility model does not exist, and provide proponents with guidance on establishing suitable representative modelling to best prepare them for any future NER 5.3.9 process.

*This will outline the support available from AEMO to prepare a model and will best prepare facilities for any future alteration and remove significant risks of delay in the process.*

## 1.6 Generator Alteration Framework Guide (GAFG)

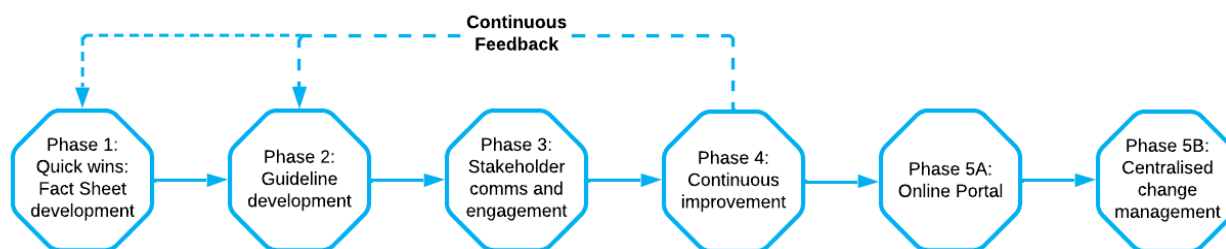
Recommendation 2 is that AEMO develop a Generator Alteration Framework Guide. This recommendation (combined with necessary amendments to the NER) is considered the most beneficial improvement that can be made in the near-term, which will enable NER 5.3.9 to better support the CRI aims.

The GAFG will be a comprehensive suite of information and tools to support proponents through the process of making an alteration to a generator.

The guide, among other benefits, would:

- Assist proponents to properly assess if their alteration triggers NER 5.3.9 (as opposed to other existing NER alteration processes), through clarification on whether the NER 5.3.9 pertains to different alteration scenarios.
- Provide alignment of process between proponents, NSPs and AEMO
- Support proponents in preparing documentation and submitting their application, and for NSPs and AEMO to assess and respond with transparency, including ensuring alignment on the Generator Performance Standards to be assessed as part of the alteration.

It is recommended that the GAFG be initially developed as a Fact Sheet, with supporting FAQ (akin to the sugar mill fact sheet published by AEMO<sup>1</sup>), and then fully developed into more detailed guidance over a series of phases.



Implementing a Generator Alteration Framework Guide will support efficient change management across the NEM.

If this recommendation is progressed by AEMO, Phase 1 could be complete by early Q1 2024, and provide immediate benefit, clarity, and certainty to the energy market.

The GAFG is explored and detailed more thoroughly in 7.3 and further in Appendix 6 - .

## 1.7 Conclusion

It is evident that NER 5.3.9, as written and currently interpreted, is not providing effective outcomes for proponents, NSPs, AEMO or the broader energy market as a whole. As the energy market continues to evolve and adapt to new technologies, notably the growth of renewable energy generation, NER 5.3.9 stands as an obstacle to the efficient alteration to connected generators.

<sup>1</sup> [https://aemo.com.au/-/media/files/electricity/nem/network\\_connections/registration-and-alteration-of-a-generating-system-sugar-mill-fact-sheet.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/network_connections/registration-and-alteration-of-a-generating-system-sugar-mill-fact-sheet.pdf?la=en)



While NER 5.3.9 is a vital change management clause, ensuring the grid remains safe and stable, it lacks clarity and invites misinterpretation, which is adversely impacting the ability of proponents to adapt and implement generator alterations which would bring net benefit to the system.

The recommendations of this review are well within the capability of industry, led by AEMO and supported by the CRI, to implement over the near-term, and will provide a significant improvement to the NEM connections process.

# 2 Background

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## 2.1 Connections Reform Initiative

This report has been commissioned as part of the broader Connections Reform Initiative (CRI); a joint program of the Australian Energy Market Operator (AEMO) and the (Clean Energy Council) CEC. The CRI is tasked to lead the development of solutions to the most pressing concerns affecting the National Electricity Market (NEM) generator connections process.

The national electricity grid is undergoing a period of significant change, driven largely by the number and scale of renewable energy systems joining the grid, while at the same time traditional generator sources such as coal fired generation are being retired.

The generator connection process requires modernisation to ensure that these new projects can be connected in a timely and cost-effective manner, while equally enabling the energy system to become responsive to the evolution of generation technology and capability, now and into the future.

As part of previous CRI work on the NER 5.3.9 application, 9 guiding questions were developed (provided in Appendix 8 - which Clutch has also considered in shaping this review and our recommendations.

## 2.2 National Electricity Rules

The National Electricity Rules (NER) provide the regulatory framework and processes necessary for the national electricity system to function, including the process for network connections and access.

The NER 5.3.9 process review is one of ten workstreams which have been addressed as part of the CRI program. This review sought to reframe how NER 5.3.9 process is applied to provide an efficient, cost effective, consistent, and transparent approach for all stakeholders.

## 2.3 NER 5.3.9

Clause 5.3.9 of the National Electricity Rules (NER) “*Procedure to be followed by a Generator proposing to alter a generating system*”, applies when a Generator seeks to:

1. *alter a generating system that is either already in operation; or*
2. *is still in the connection process but has had Generator Performance Standards (GPS) accepted by AEMO and the relevant NSP under NER 5.3.4A.*

and the proposed alteration will:

1. *affect the performance of the generating system relative to any of the technical requirements set out in clauses S5.2.5 S5.2.6, S5.2.7 and S5.2.8; or*
2. *in AEMO’s reasonable opinion, have a general system strength impact; or*
3. *in AEMO’s reasonable opinion, adversely affect network capability, power system security, quality or reliability of supply, inter-regional power transfer capability or the use of a network by another Network User.*

### 2.3.1 Assumed Intent

While there is presently nothing which clearly defines the intent of NER 5.3.9, the assumed intent of NER 5.3.9 is to provide a change management process whereby AEMO and the relevant NSP has the opportunity to confirm whether a proposed alteration to a generating system will impact its ability to meet the already agreed performance standards.

The rule also provides the opportunity for AEMO and the NSP to assess if there is any risk of adverse impacts to the network.

It is important to highlight that the rule applies once performance standards have been agreed upon under NER 5.3.4A. This can be prior to registration and/or commissioning of the new generator connection, as NER 5.3.4A is enacted as part of a new connection process.

NER 5.3.9 is also intended to ensure a generator's GPS reflects the latest performance following the alteration to the generating system.

### 2.3.2 Different Alteration Provisions Under the NER

NER 5.3.9 is one of four NER provisions that cater to proposed alterations to generating unit equipment, performance, or control settings. There are occasions when it is not clear to proponents which NER provision should be applied for a given alteration scenario. The NER does not provide clear guidance on when to apply each of the NER provisions.

The table below summarises the current provisions within the NER for managing the various changes which may apply to generators.

NER Clause	Application
5.3.9	Procedure for the proponent, AEMO and the NSP to follow when the proponent proposes to alter a generating system that is connected or has had performance standards already accepted by AEMO and the relevant NSP under clause 5.3.4A.
4.14(p)	Procedure to be followed for amendment of registered performance standards by agreement between AEMO, the proponent and the relevant NSP.
S5.2.2	Procedure to be followed for application of new or changed settings to a control or protection system following approval by the NSP and AEMO (where relevant).
5.6.2	Notification and removal of inconsistencies between proposed equipment and connection agreement/GPS, where identified during pre-commissioning.

## 2.4 The Case for Change

Issues with understanding and application of the NER 5.3.9 process, along with variances of generators and technology, is impacting opportunities for existing plant to invest to improve generator/fleet performance or make improvements to extend the life of aging fleet. This in turn restrains the efficient and orderly energy market transition.

As the NEM undergoes a period of change, proponents, NSPs and AEMO need to have clear agreement, guidance and understanding to support alterations to connected generators. Clarifying NER 5.3.9 will:

- Reduce barriers to proponents introducing new technology.
- Reduce cost and uncertainty to proponents through standardisation of applications.
- Enable investment and improvements to the existing generation fleet, which would provide overall system and supply benefit.
- Support the introduction of additional capacity behind existing connections, which is the most efficient manner to add additional capacity to the NEM and improve overall facility and system performance.
- Prepare the NEM for the changes to facilities and generators which will be necessary as the network condition evolves.
- Support the adjustment of generator performance in response to the evolution of network strength and system conditions.

A reformed NER 5.3.9 has the potential to bring investment, stable growth and new technology to the NEM.

## 3 Review Process

The approach taken to review the existing NER 5.3.9 Process was conducted over four phases:

- Phase 1: a review of the CRI NER 5.3.9 workstream background information, including the CRI's 9 guiding questions (provided in Appendix 8 - .

- Phase 2: A literature review of publicly available documents regarding NER 5.3.9 and an internal assessment by Clutch of the NER 5.3.9 process and limitations.
- Phase 2: A series of six facilitated workshops with members of the CRI Technical Working Group (TWG). These workshops aimed to understand the critical issues with the current NER 5.3.9 process and the impacts these issues are having on the industry, as well as to explore potential ideas for solutions to the key issues identified.
- Phase 3: Recommendations and report drafting.

The structure of this review was selected to bring clear and independent thinking to how the industry views the NER 5.3.9 process and limitations.

### 3.1 Literature Review

The literature review was an opportunity to identify and collate all the publicly available information as well as information that a proponent would be reasonably expected to have access to. The aim was to build a picture of the NER 5.3.9 process from reliable documentation.

Clutch approached the literature review from the position of a proponent seeking to make a generator alteration for the first time, with access to a reasonable level of internal expertise and resources. From this documentation, Clutch then formed an opinion of how and when NER 5.3.9 should be applied.

Clutch was then able to apply their real-world experience and expertise to identify the gaps in the scenario proponent's knowledge. This gap analysis then informed the design and functions of the workshops, as did the CRI's 9 guiding questions (provided in Appendix 8 -

### 3.2 Workshops

A series of six workshops were conducted with members of the TWG. These workshops aimed to understand the critical issues with the current NER 5.3.9 process and the impacts these issues are having on the industry, as well as to explore potential ideas for solutions to the key issues identified.

The participants of the workshops were invited to register to participate in the workstream as TWG members (and were identified through a broader pool of CRI working group members). This group included representatives from:

- Generation development organisations,
- Original Equipment Manufacturer (OEM) organisations,
- Technical consultants,
- NSPs, and
- AEMO.

Clutch considers that the TWG was a diverse, independent, and representative sample of industry, and that appropriate opinions and expertise was present and heard during the workshops.

The workshops were designed to build on the literature review and gap analysis, to ensure that all parties had a voice in the review process.

The workshops were:

1. Workshop 1 – Understand NSP and AEMO perspectives.
2. Workshop 2 – Problem definition.
3. Workshop 3 – Align on issues and consider high level solutions.
4. Workshop 4 – Issues characterisation.
5. Workshop 5 – NER 5.3.9 intent.
6. Workshop 6 – Explore potential solutions.

### 3.3 Findings, Recommendations and Report Drafting

The final phase of this review was to form recommendations and prepare this report.

While the workshops and literature review provided significant detail and insight, ultimately the recommendations of this review have been formed through Clutch's independent assessment of all the relevant material and evidence.

The electricity market is a complex technical environment, and each proponent's connected system vary, and their specific alteration challenges are nuanced. Similarly, the needs, challenges and capacity of NSPs vary significantly across regions. It is acknowledged that no two NER 5.3.9 processes can or will be the same, and that the NER 5.3.9 cannot possibly detail or accommodate every possible generator alteration scenario.

In order to produce recommendations that are actionable, beneficial and relevant to the greatest number of alteration scenarios, Clutch distilled the evidence and feedback from the workshops down to six key issues. The recommendations were then formed to best respond to and correct these identified issues, while allowing flexibility to adjust to additional alteration scenarios and issues as they emerge.

# 4 Independent Assessment & Literature Review

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## 4.1 Literature Review of NER 5.3.9 Process

To ascertain a view on the intent and application of NER 5.3.9 across the NEM, Clutch conducted research to identify recent examples of the NER 5.3.9 process being undertaken.

Notably, no publicly available information was discovered regarding NER 5.3.9 applications or outcomes - thus no precedents exist in the public domain to inform or guide future applicants.

It was also confirmed there are no publicly available records of historical completed generator alterations under NER 5.3.9.

The literature review was also unable to identify any sort of guidance or explanatory notes from AEMO or individual NSPs on the application of NER 5.3.9, or information as to the process that a proponent could expect in considering an application. Nor did the literature review provide examples of interpretation which might support a proponent or NSP to make the best decisions against an application.

While the literature review provided no significant inputs, the defined literature and information gaps provided strong support as to the need for NER 5.3.9 to be placed under a more thorough review.

## 4.2 Independent Assessment

Clutch has had considerable experience in working with and applying the NER 5.3.9 process, and with grid connections on the NEM more broadly. This experience has given Clutch the opportunity to view the NER 5.3.9 from all party's perspectives and balance the report appropriately.

### 4.2.1 General Observations

In Clutch's experience, a general pattern of approach is that proponents, after some basic research on NER 5.3.9 (which is limited as noted by the literature review above), will attempt to self-diagnose and develop a plan for an appropriate alteration process which nominally would be a path that best supports their needs.

The proponents then approach their NSP and AEMO, with a formed set of expectations and how the parties will undertake the alteration process. NSPs and AEMO then begin their own planning and assessments, which can differ from the proponents' plans and expectations, resulting in delays and frustrations for all parties involved.

Conversely, a proponent's self-diagnosis does on occasions result in them ending a planned alteration, and never approaching their NSP or AEMO. This is because they have determined the alteration to be unviable, on the assumptions of how the NSP or AEMO would apply the NER 5.3.9 rule. It is possible in these circumstances that the proponent has misinterpreted the rule and denied themselves and the system the opportunity for improvement.

### 4.2.2 A-priori Assessment

Having considered the limited publicly available information, Clutch reflected on their own experiences with NER 5.3.9 to form an a-priori list of areas of strengths and weaknesses, which would drive the workshop processes. These strengths and weaknesses align strongly with the challenges and opportunities considered in the CRI's 9 guiding questions (see Appendix 8 -

## 4.3 Assessed Areas for Improvement

The potential areas for improvement of NER 5.3.9 process are grouped into four themes.

#### 4.3.1 Theme 1 – Uncertainty and lack of clarity:

- The process is lacking in freely available information for proponents looking to plan a generator alteration.
- The process is unclear and confusing for all parties involved – this leads to confusion on the process to be followed.
- The alteration process is daunting for proponents.
- The NER is not clear on the practical application of the process.
- There are multiple pathways available for the proponent when proposing a generator alteration, adding to the confusion and inconsistency.

#### 4.3.2 Theme 2 – Inconsistency of application

- Proponents often look to the NSP and AEMO for guidance on the matter, and depending on experience within the NSP and AEMO, this can result in inconsistency of application.
- There is lack of consistency in the process even down to individual level, let alone at NSP and AEMO level.
- Often proponents believe the costs and scope of the works is much higher than required, noting this may be a perception, rather than being factually aligned with what is necessary in practice.
- Often results in a disconnect between the expectations of the NSP / AEMO and the proponent.

#### 4.3.3 Theme 3 – System improvements are being impacted

- Discourages investment as proponents are concerned with potentially impacting existing assets.
- Minor improvements are not being made for fear of an unfavourable NER 5.3.9 outcome.
- The NEM as a whole is missing out on an efficient way to add new capacity (and support the energy transition) when proponents, through fear of the alteration process, are avoiding increasing generator capacity and leveraging available land and connection infrastructure.

#### 4.3.4 Theme 4 – Pressure on resources

- The need for change is often at the point where time pressure for an outcome is considerable, i.e. during design and construction or commissioning, so it is often a high pressure situation for all involved;
- Inefficiencies in NER 5.3.9 application take valuable and limited engineering resources away from supporting other generation connections, impacting on the overall energy transition outcomes.

### 4.4 Assessed Strengths

The NER 5.3.9 process is not entirely without merit or success. There are numerous examples of the process being effective and operating smoothly to deliver positive outcomes.

The process works best when the parties:

- come together early in the alteration planning phase to map out, understand and agree the process to be followed, agree on appropriate timeframes, and align on the scope of work to be undertaken.
- are able to apply engineering judgement as to what is appropriate for the process upfront (noting the NER does restrict decision makers discretion in several aspects).
- ensure the inputs into the process are of high quality.

Figure 1 highlights, at a high level, the current NER 5.3.9 process to help visualise where there are opportunities for improvement.



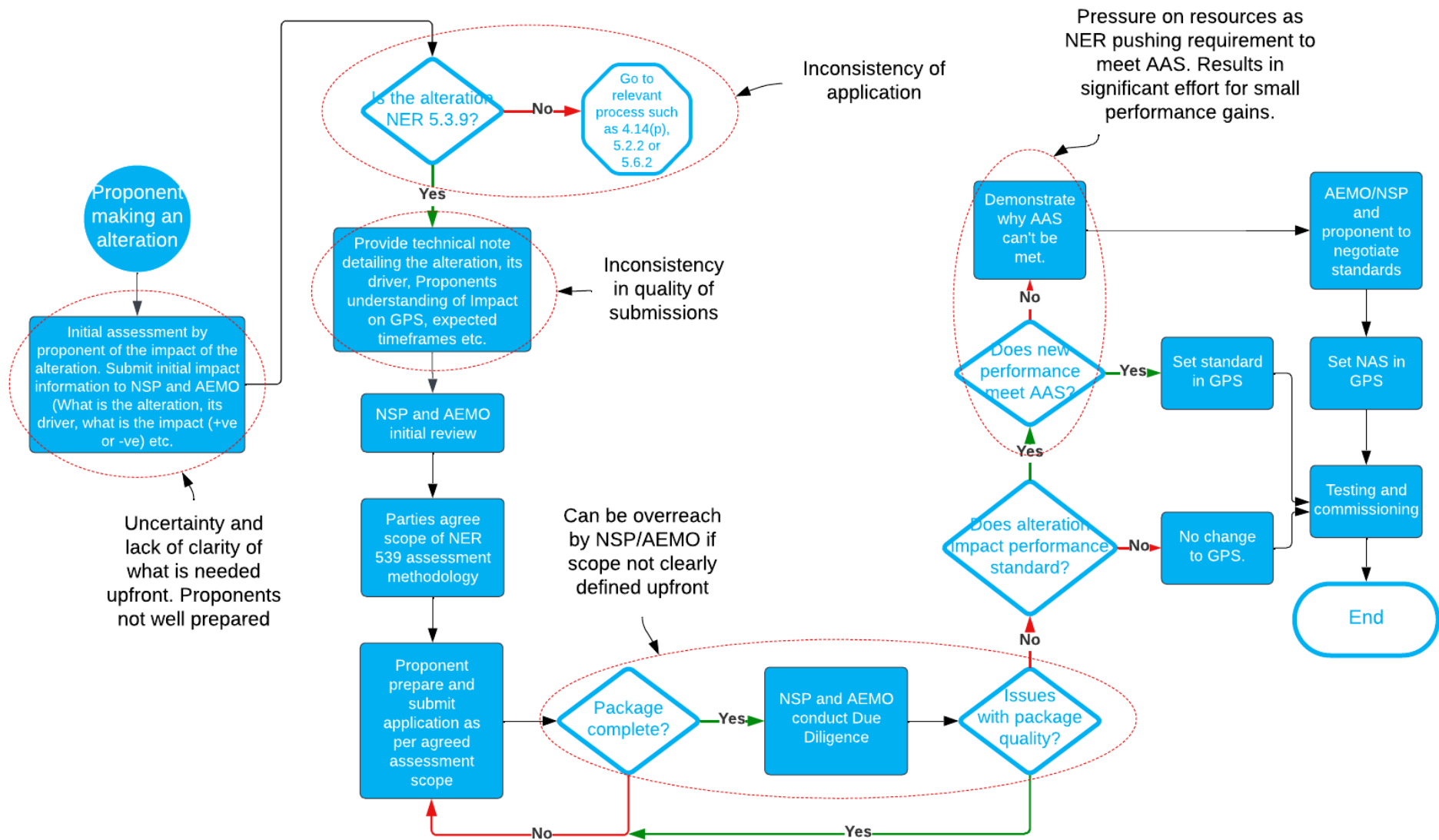


Figure 1 - The current NER 5.3.9 process, highlighting the areas which require improvement.

# 5 Workshops

The main effort of this review was the conduct of the six workshops, which were designed and facilitated by Clutch. The workshops were guided by the themes of weakness as noted in Section 4.

Workshops 1, 2 and 3 provided problem/issue definition and initial solution architecture, with Workshop 4 being focused on issue characteristics, with inputs from the previous three workshops.

The insights and outputs gained were then assessed in Workshop 5, to test the intent and application of the NER 5.3.9 rule. Finally Workshop 6 explored the preferred solutions and enablers. Figure 2 below provides an overview of the workshop approach.

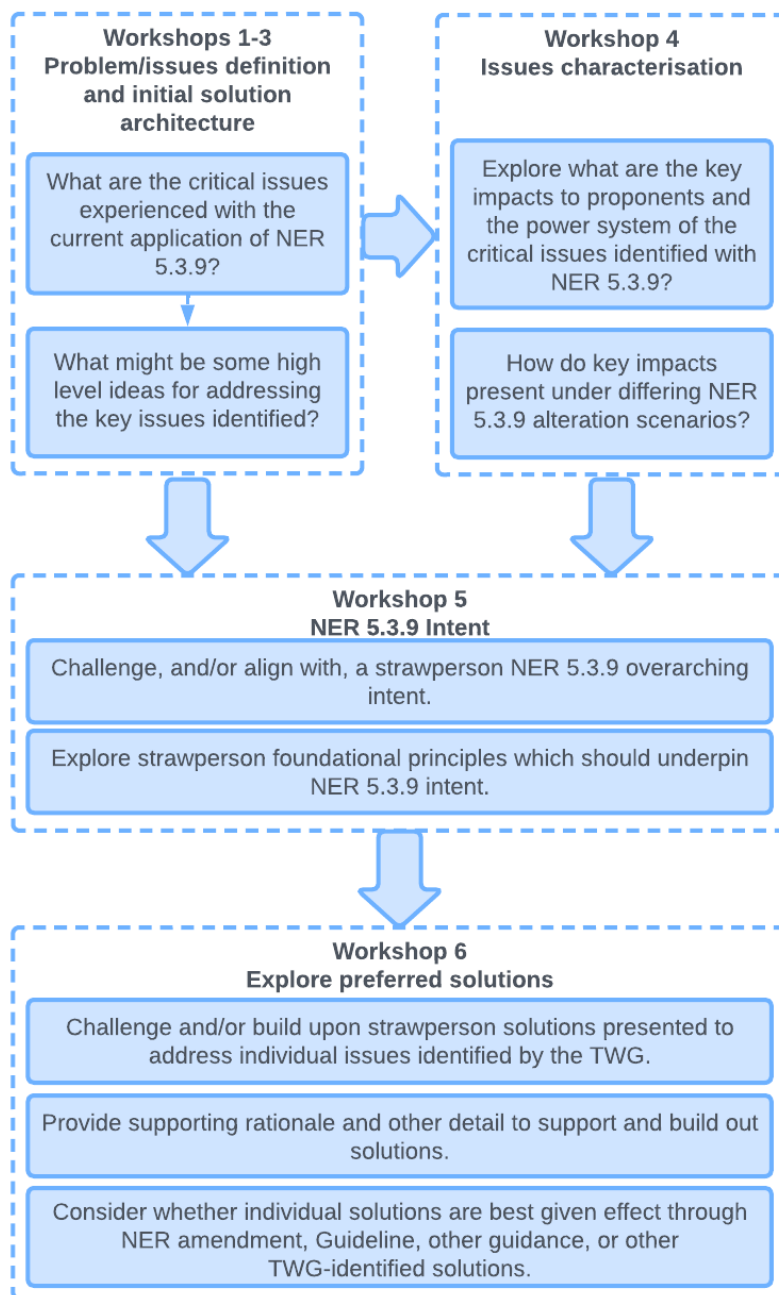


Figure 2 - Workshop structure and process flow.

The objective of each of the workshops are shown below. Further detail on the outcomes and findings from each workshop is provided in Appendix 1 -

<p><b>Workshop 1</b> <b>Understand NSP and AEMO perspectives</b></p>	<p><b>Workshop 2</b> <b>Problem Definition</b></p>
<ul style="list-style-type: none"> <li>• Provide an overview of the NER 5.3.9 Process Review scope, approach, and engagement</li> <li>• Gauging views on the value of refining the NER 5.3.9 Process</li> <li>• Understand and share NSP perspectives on the effectiveness of the current NER 5.3.9 Process</li> <li>• Identify quick wins for development as strawman options for discussion with broader Technical Working Group.</li> </ul>	<ul style="list-style-type: none"> <li>• Share perspectives on effective elements of the current process (to be leveraged and retained);</li> <li>• Understand the ‘must-haves’ in the current NER 5.3.9 Process (must be retained);</li> <li>• Align on the ‘Top 3-5’ critical issues with the current NER 5.3.9 Process; and</li> <li>• Identify and refine potentially feasible preliminary solutions to agreed critical issues.</li> </ul>
<p><b>Workshop 3</b> <b>Align on issues and consider high level solutions</b></p>	<p><b>Workshop 4</b> <b>Issues characterisation</b></p>
<ul style="list-style-type: none"> <li>• Align on the top 5 critical issues based on outcomes of Workshop 2 and the pre-Workshop 3 survey; and</li> <li>• Test and refine potential solutions to the critical issues agreed above,</li> <li>• As well as, in tandem, providing solutions to less critical issues as a bi-product.</li> </ul>	<ul style="list-style-type: none"> <li>• Further characterise the most critical NER 5.3.9 issues and provide additional information to help shape solution development. <ul style="list-style-type: none"> <li>○ Impacts of the critical NER 5.3.9 issues on TWG members and impacts to the power system.</li> <li>○ Impacts as they relate to high-level NER 5.3.9 alteration scenarios</li> </ul> </li> </ul>
<p><b>Workshop 5</b> <b>NER 5.3.9 Intent</b></p>	<p><b>Workshop 6</b> <b>Explore potential solutions</b></p>
<ul style="list-style-type: none"> <li>• Align on what the intent of the NER 5.3.9 process should be and to test the TWGs thinking as to whether the intent varies with the different alteration scenarios tested in Workshop 4. <ul style="list-style-type: none"> <li>○ Based on the identified issues with NER 5.3.9 and their associated impacts, how should changes to generating systems be managed?</li> <li>○ What considerations are there in defining the intent of NER 5.3.9?</li> <li>○ Is the intent of NER 5.3.9 different for differing alteration scenarios, or is the application of NER 5.3.9 different?</li> <li>○ Seek alignment on the overarching intent of NER 5.3.9</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Explore solutions to NER 5.3.9 issues identified by the TWG. <ul style="list-style-type: none"> <li>○ Challenge and/or build upon straw person solutions presented to address individual issues identified by the TWG.</li> <li>○ Provide supporting rationale and other detail to support and build out solutions.</li> <li>○ Consider whether individual solutions are best given effect through NER amendment, Guideline, other guidance, or other TWG-identified solutions.</li> </ul> </li> </ul>

# 6 Findings

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## 6.1 Key Finding

The key finding of this review is that NER 5.3.9, as written, invites broad and divergent interpretations on its intention and application.

The rule is in part ambiguous, and yet also constrained in parts as to limit the discretion of decision makers to approve what would otherwise be beneficial generator alterations.

Under the current status quo, NER 5.3.9 will continue to impact the efficient implementation of generator alterations, deterring investment and slowing the modernisation of Australia's generator sources across the NEM.

This key finding is underpinned by six general findings, which were distilled from the TWG workshops (specific issues identified during the TWG workshops are detailed in Appendix 2 - :

1. Proponents, NSPs and AEMO each have inconsistent views on when, where and how NER 5.3.9 is applied;
2. There is a lack of information to support Proponents to understand and correctly apply NER 5.3.9 to their operations;
3. The performance standard requirements imposed under NER 5.3.9, via parts of NER 5.3.4, limits the opportunity for alterations which may provide a 'net benefit' to the power system;
4. There is uncertainty as to the scope and application of NER 5.3.9 when making alterations to legacy plant;
5. Proponents, NSPs and AEMO are unclear on the roles and responsibilities they have in regard to NER 5.3.9; and
6. NER 5.3.9 does not address the retrofit of Battery Energy Storage System (BESS) into, or the creation of hybrid systems within, existing connections.

### 6.1.1 Consensus

There was a high level of consensus within the TWG in these findings. There was evidence of a collective will amongst the TWG that this review presented a timely opportunity to improve the NER 5.3.9 process.

## 6.2 Finding 1 – Inconsistency of Application

There is inconsistency in the application of the NER 5.3.9 clause across all parties, and even individuals within organisations.

Stakeholders identified inconsistency in the application of the rule between NSPs, between individual engineers within a given NSP or AEMO, or between different alteration scenarios.

This inconsistency resulted in a far more involved and detailed process than proponents may have expected.

Several proponents reported that what they considered relatively minor changes, such as firmware updates which were not intended to alter performance and were perhaps only intended as small bug fixes, became subject to involved assessments. While other stakeholders reported extensive assessments when attempting to replace equipment like-for-like; where the proponent did not expect any performance impacts.

The drivers of this issue are assessed to be:

- Experience of the NSP or AEMO engineer involved or the differing requirements between individuals undertaking the NER 5.3.9 assessment.
- The varying quality of the information provided by the proponent regarding the nature of the alteration.

- A lack of understanding of the intent of the NER 5.3.9 process, which resulted at times in a lack of understanding regarding what the NER 5.3.9 process is not intended to deal with, for example alterations driven by AEMO or the NSP.
- A lack of clarity around the roles, responsibilities and expectations of the parties involved in the NER 5.3.9 process.
- There was no clear and consistent mechanism for pursuing alterations driven by the NSP or AEMO.
- There is no clear guidance for NSPs and AEMO on how a NER 5.3.9 process should be assessed for given alteration scenarios.
- No clearly documented/agreed scope at the start of the NER 5.3.9 process.

### 6.3 Finding 2 – Proponent Preparation

Proponents were found to approach AEMO and NSPs in an under prepared state for a generator alteration. AEMO and NSPs highlighted circumstances where information to substantiate a proposed alteration was at times non-existent, or lacking in detail to the extent that it was difficult for the NSP or AEMO to understand the full nature of an alteration or assess its impacts.

The inconsistent application of NER 5.3.9 as discussed at Finding 1, meant that often even an experienced proponent could become misaligned with the NSP or AEMO on the overall process.

While some proponents had the benefit of internal experienced and lessons hard learnt, overall the lack of reliable information on the requirements of the application of NER 5.3.9 and the overall alteration process, left proponents unprepared. This has resulted in less-than-ideal project planning for an alteration - driving poor assessments on timelines and the subsequent certainty around project investments by the proponent, projects sponsors and financiers.

Stakeholders agreed that the lack of preparation, or misalignment of planning between stakeholders, is driven by:

- A lack of information available on the NER 5.3.9;
- A lack of opportunity to undertake an NER 5.3.9 process. Participants may not have undertaken a generator alteration in the past and as such, have not had a chance to develop a good appreciation of what is required;
- Inconsistencies in application by different NSPs and different engineering staff within NSPs and AEMO. Likewise, NSPs and AEMO have lost a level of experience in recent years, through retirement of experience staff. There are less individuals with the same level of knowledge of Australia’s ageing power system as there once was.

It is also important to note, as addressed in Section 2 (Background), that there are several alteration mechanisms within the framework of the NER. This presents a further risk for a proponent, NSP or AEMO to become misaligned on the NER requirements.

### 6.4 Finding 3 – Limitations under the current NER drafting

There are existing limitations in the wording and application of the current NER. These limitations stem from a lack of clarity of the intent of the NER clauses, which may not be intended to be as prescriptive as currently drafted. NSP and AEMO may adhere to strict legal interpretations, which may not always account for the practicality and impact on the power system - as the NER may intend.

#### 6.4.1 Inability to reduce performance according to NER 5.3.4A(b)(1A)

Stakeholders highlighted the inability to be flexible when renegotiating performance standards during a generator alteration.

The key barrier to any flexibility is the requirements within NER clause 5.3.4A(b)(1A) which states:

- (b) *A negotiated access standard must:*

*(1A) with respect to a submission by a Generator under clause 5.3.9(b)(3), be no less onerous than the performance standard that corresponds to the technical requirement that is affected by the alteration to the generating system;*

This clause suggests that any alteration under NER 5.3.9 should not result in the reduction in performance corresponding to any of the relevant performance requirements.

This clause was amended in 2018 to give greater protection to proponents making an alteration by setting the negotiation range between the AAS at the time of the application (contemporary AAS), and the negotiated access standard agreed in a generator established performance standards (applied standards).

This rule change was intended to address concerns that a generator might be impacted following an alteration of plant where the minimum access standards had increased above the plant's negotiated performance standard since the plant had originally agreed its GPS.

The final 2018 rule included the new provision to:

*“make it clear that, when a negotiation of performance standard relates to the alteration of equipment in clause 5.3.9, the negotiating range is between the automatic access standard and the generator's corresponding existing performance standard (rather than the corresponding minimum access standard in the NER)”.*

The workshops highlighted that there are proponents and NSPs who have interpreted this clause in the strictest sense, where reduction to any performance standards is not acceptable. While other stakeholders have taken a more holistic approach in assessing performance in accordance with the requirements of NER clause 5.3.4A(b)(1A) by allowing reductions in performance against a particular clause, if the overall facility performance is improved (i.e. offers additional benefits to the system which might be traded off against a reduction in another area of performance).

Both NSPs and proponents have reported being at times frustrated through the NER 5.3.9 process by the requirement to continue to meet specific technical obligations in cases where a reduction in certain areas of performance may have delivered more favourable system outcomes.

Workshop participants described a need for greater flexibility within the framework of the NER to accept reduced performance from what was originally agreed. This might be the case where:

- There are sound engineering reasons for accepting such lower performance.
- Detailed design during R1 phase results in slightly reduced performance from the agreed performance standards, where the performance has no material impact on the power system.
- There are trade-offs, or other benefits, brought about by a generator alteration. A key example being the improved system strength benefits vs reduced Iq injection offered when transitioning from grid following to grid forming inverter mode with a BESS.

NSPs recounted instances where they would have been comfortable accepting lower performance proposed by a proponent under an NER 5.3.9 application, however a strict interpretation of the NER wording prevented them from accepting such lower performance, despite their engineering judgement suggesting the reduction was appropriate.

This clearly highlighted the impacts the current drafting of the NER was having on the outcomes of NER 5.3.9 applications.

#### **6.4.2 Requirement to increase performance to meet the Automatic Access Standards (AAS) according to NER 5.3.4A(b1)**

Stakeholders highlighted the issue of being forced to increase performance standards when undertaking an alteration under NER 5.3.9. Participants considered there had been circumstances where an NER 5.3.9 alteration had created a risk of having to re-open plant GPS to push for higher performance.

This issue stems from NER 5.3.4A(b1), which states:

*(b1) When submitting a proposal for a negotiated access standard under clauses 5.3.4(e), 5.3A.9(f), 5.3.9(b)(3) or subparagraph (h)(3), and where there is a corresponding*



*automatic access standard for the relevant technical requirement, a Connection Applicant must propose a standard that is as close as practicable to the corresponding automatic access standard, having regard to:*

- (1) the need to protect the plan from damage;*
- (2) power system conditions at the location of the proposed connection; and*
- (3) the commercial and technical feasibility of complying with the automatic access standard with respect to the relevant technical requirement.*

Technical Working Group members questioned whether the intent of NER 5.3.9 is to test compliance with established performance standards following an alteration to generating plant, or whether the intent is to use the opportunity of a generator alteration to seek improved generator performance by way of the NER 5.3.9 process.

The scenario where the NER 5.3.9 process is being used to seek improved performance of generators is creating significant uncertainty for proponents who are unclear about the extent of the studies they will be exposed to, nor whether they would require additional capex to meet increase performance expectations.

## 6.5 Finding 4 – Challenges making alterations to legacy plant

In the context of this report, Legacy Plant is existing connected generation which established its performance standards before the current performance and plant modelling requirements existed. For example, before the requirements for detailed PSCAD (Power Systems Computer Aided Design) models existed (as currently required under the Power System Model Guidelines (PSMG)).

### 6.5.1 Applicability of the current Minimum Access Standards (MAS) to plant for which that standard did not exist at the time the plant's original GPS was registered

When a generator with established performance standards makes an alteration, there are no clear provisions within the NER detailing the applicability of new performance requirements which did not exist at the time the generator originally established its performance standards.

There can be significant differences between the current standards (at the time of the alteration), and the standards at the time of the original connection and GPS agreement.

There may be circumstances where an existing performance standard is silent on a particular requirement, while actual performance of plant may be less than current minimum access standards.

This creates uncertainty and concern for proponents as at the time of an alteration, as there is a risk of a new requirement for plant to meet a new standard which it was not designed to meet. As such, any requirement to meet new standards could result in significant investment risk to proponents and a lack of clarity over the obligation to meet new requirements is a deterrent to making any alterations.

### 6.5.2 Legacy plant without suitable generator models

The requirements to provide plant models for plant undertaking an alteration is often a barrier for proponents in seeking to make alterations as often it is very difficult to create models without support of the OEM.

The preparation of suitable models often requires input and involvement from the plant OEMs, who may no longer be available, no longer commercially involved with the proponents or may be unwilling to support model development.

Model development then becomes very difficult, time consuming and costly which can discourage proponents from making alterations.

### 6.5.3 Concerns with impacts on existing plant performance

Proponents highlighted the risk of having to renegotiate performance standards for existing plant at the time an alteration is made. There were reported instances (although how widespread these are isn't



clear) where Network Service Providers (NSPs) have used alterations to modify performance against certain performance standards which are not impacted by the alteration, as a mechanism to seek improvements which might offer a system benefit attractive to the NSP.

In other words, there are some instances where NSPs may have used the opportunity of a generator making an alteration to request improved performance as an efficient, low-cost way of assisting them meet their power system management obligations.

This creates significant risk to the asset owner and financiers as there is no certainty of protection for established performance standards, which discourages proponents from making improvements to generators.

## 6.6 Finding 5 – Uncertainty over roles and responsibilities

There is often confusion or a lack of understanding in the industry over roles and responsibilities on the proponent, the connecting NSP and AEMO throughout a generator alteration process. This issue presents in different ways, including:

- It has been suggested that at times, NSPs/AEMO may have gone beyond their responsibilities, requesting additional studies to assess performance against all clauses.
- Proponents are not always aware that it is their obligation to ensure their facility remains compliant with performance obligations. This means they need to undertake sufficient investigation at the outset of an alteration process to ensure a clear understanding of how an alteration might impact their facility performance and associated compliance obligations.
- applicants have not always provided quality, correct data, and models to sufficiently demonstrate the impact (or confirm there is no impact) of their proposed alteration.

Overreach may be driven by concern from NSPs and AEMO due to proponents not always being aware of their obligations under the NER. Proponents should be made aware of their obligations and ensure they are proactively driving accountability and ownership.

NSPs and AEMO have obligations for managing power system security under the NER and to ensure compliance with these obligations, the connecting NSP and AEMO need to be informed and understand the impact of changes that have the potential to affect generator performance and the power system.

There also appears to be a lack of accountability on NSPs and AEMO in terms of timeframes in which to respond to applications under NER 5.3.9. Currently, within the NER 5.3.4A framework, there are mandated timelines for NSP and AEMO to accept or reject proposed negotiated access standards. These timeframes do not mean the negotiation process will be resolved within these timeframes (another area of uncertainty over responsibilities); however they do provide a level of certainty around process timeframes.

Workshops identified that in practice, such timeframes are being applied to the negotiation of access standards within the NER 5.3.9 framework for generator alterations (as is provided for under NER 5.3.4A(e)). As such, the NER 5.3.4 timeframes are already consistent and applicable to NER 5.3.9 (This also addresses guiding question 4 shown in Appendix 8 - .

## 6.7 Finding 6 – More work is needed to support BESS retrofit

As part of the energy transition generation owners are seeking to leverage spare capacity within connections infrastructure to retrofit BESS units behind a connection point. This allows proponents to connect at a lower cost by leveraging existing connection infrastructure, while offering benefits to their generating system such as energy arbitrage, system strength or participation in ancillary service markets.

Discussions highlighted challenges with adding a BESS or creating a hybrid generating systems behind an existing connection point. The challenge here is one of how to treat the interaction of the performance between the new BESS/generation infrastructure and the existing generating plant.

There may be circumstances where performance can be separately assessed and measured, to effectively ‘quarantine’ the performance of the existing and new generating plant. However this is not

always possible within the framework of the current NER which requires performance to be assessed and measured at the connection point.

This issue results in risk to proponents of having to re-open the performance standards for the existing generator, which may not have sufficient facility models available, or may be owned by a separate entity, creating risk for another party.

While this is not strictly an NER 5.3.9 issue in that often a new BESS facility may be treated as a new connection (depending on the connection configuration) and become a separately registered facility, the issue of how to manage the impact to existing facilities is one which overlaps with NER 5.3.9.

Presently, it is unclear how to treat the inclusion of BESS, and what will be examined and why a particular process will be undertaken.

## 6.8 Best Practices

In the course of this review, Clutch was able to identify several of the best practices which have supported smooth, timely and successful NER 5.3.9 processes.

The recommendations have been prepared with the understanding that parties would in the future seek to apply these best practices to any NER 5.3.9 application.

The best practices highlighted by this review are:

- **Close Working Relationships with NSP & AEMO** - Proponents have engaged with their NSP and AEMO early and regularly. They have proactively sought to agree on scope, approach, inputs, outputs, expected timeframes. Likewise, the NSP and AEMO actively work to establish a collaborative approach to the proposed alteration.
- **Using the NER 5.3.4A timeframes as guidance** – It has been helpful when parties have used the stipulated NER 5.3.4A timeframes in planning and preparing for the NER 5.3.9 process, and all parties agree to work toward these in principle.
- **Experienced and Knowledge** - stakeholders have the requisite experience and knowledge within project teams, and appropriately resource the alteration process.

### 6.8.1 Minimum requirements to Propose an Alteration.

Following from the general principles of the best-practices noted above, this review was also able to identify the minimum requirements necessary for a proposed alteration to proceed through the NER 5.3.9 process.

In no particular order of priority:

- **New generation capacity must be assessed against new NER requirements.**
  - Proponents must assess any new generation capacity against the latest version of the rules. This does not mean the full generation facility needs to be assessed against new requirements, however any new capacity must.
  - Failure to do this will almost certainly block, or significantly delay the process.
- **Proponents must be prepared for NSPs and AEMO to modify the assessment scope.**
  - Studies by the participant or participant/NSP/AEMO due diligence may deem it necessary to modify the scope of the assessment. All parties should, following the best-practices, be prepared to cooperate and find the net-benefit to the proposed alteration.
- **Proponents must have a working model of the generating system.**
  - For those alterations for which require a model to assess the impact of the alteration and the extent the impact may have on the power system, proponents must have prepared suitable model, or seek early agreement to use a generic or library model alternative.
- **An in-depth statement about the alteration(s) to the generating system.**

- Proponents must prepare quality information and conduct thorough assessments of the impact of their alteration. Quality information from the proponent is critical in supporting any claims about the impact of an alteration on performance.
- Failure to produce quality and complete information will delay the process and may result in additional due diligence studies by the NSP and AEMO; which could otherwise be avoided.
- **Connection Agreements must be updated.**
  - Proponents must be prepared to update the connection agreement with the agreed GPS following an NER 5.3.9 alteration process, within reason and for those NER clauses which are impacted by the scope of the alteration.

# 7 Recommendations

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## 7.1 Overview

The recommendations of the review are structured to be actionable by AEMO in the near-term and provide the maximum benefit to the NEM and NEM participants.

Clutch acknowledges that the NER as a framework cannot accommodate or fully address every alteration scenario. However, implementing these recommendations will give the proponents and decision makers greater opportunity to shape their solutions to achieve improved outcomes for most alteration scenarios and net-benefits to the system.

There are five recommendations.

1. AEMO provide increased clarity of the intent of NER 5.3.9, which is then applied across all subsequent recommendations.

*This will provide industry with greater clarity on the application and intent of NER 5.3.9 and will improve clarity and consistency of application.*

2. AEMO develop a Generator Alteration Framework.

*This will be a comprehensive suite of guidance and tools to support proponents through the generator alteration process, improving proponent education and understanding and resulting in greater consistency of NER 5.3.9 application by ensuring alignment between difference alteration scenarios and the appropriate alteration process. This recommendation will also give effect to the intent and principles from Recommendation 1.*

3. Submit a rule change proposal seeking to amend NER 5.3.4 where it limits the intent of NER 5.3.9. This rule change proposal should seek to:

- Remove requirement for a Negotiated Access Standard (NAS) to be as close as possible to the AAS per NER 5.3.4A(b1), when considering an NER 5.3.9 alteration.
- Remove requirement in NER 5.3.4A(b)(1A) which prohibits any reduction in a performance standard, when considering an NER 5.3.9 alteration.

*These amendments will enable NSPs to exercise discretion and enable Proponents to pursue alterations where there may be an impact to some part of the access standard, but that the alteration would have an overall net-benefit to the system.*

4. On conclusion of the rule change initiated under the CEC 'Enhancing investment certainty in the R1 process'; AEMO, in consultation with the CRI and the wider industry, conduct a review of the how that change has affected the treatment of alterations, where NER 5.3.9 applies, between NER 5.3.4 approval and R2.

5. *This will ensure that the necessary treatments identified in this review are sufficient to deal with alterations between NER 5.3.4 approval and R2.* AEMO contact all facilities where plant modelling is understood to be simplified, or a representative facility model exists does not exist, and provide proponents with guidance on establishing suitable representative modelling to best prepare them for any future NER 5.3.9 process.

*This will outline the support available from AEMO to prepare a model and will best prepare facilities for any future alteration and remove significant risks of delay in the process.*

Further detail on how Clutch's proposed recommendations will address the key findings of this review is presented in Appendix 3 -

## 7.2 Recommendation 1 – Provide increased clarity of the intent of the NER 5.3.9 clause

Throughout workshop discussions, the TWG explored what the intent of the NER 5.3.9 process should be.

A key finding of this review was the ambiguous nature of the NER 5.3.9 rule, and that parties were regularly applying divergent interpretations.

The below outlines Clutch’s recommendation specifically addressing the intent of the NER 5.3.9 clause, as well as general principles on its application. This will bring much needed scope to the interpretation of NER 5.3.9, ensuring consistency of application and understanding of the requirements of stakeholders in the NER 5.3 9 process.

Clutch recommends this intent statement and the guiding principles be included upfront in the AEMO Fact sheet and FAQ material (to be created under Recommendation 2). The recommended intent and principles will then be given effect to by the subsequent recommendations outlined in this section.

The recommended wording of the intent and general principles statements is included below. This wording has been refined based on Stakeholder and AEMO feedback during the NER 5.3.9 process review. Revisions made based on stakeholder feedback are discussed further in Appendix 7 -

### **NER 5.3.9 Intent**

The overarching intent of the NER 5.3.9 is to provide an efficient change management process in the NEM with the aim of:

- providing appropriate levels of **investment certainty**;
- assessing the impact of the generator alteration on the generator performance;
- accurately capturing performance of the altered plant in the GPS, plant models and associated data; and
- ensuring there is no overall degradation to the power system because of the alteration.

## **General Principles**

A proponent should not be required to renegotiate a generating system's GPS to achieve performance above what the proponent can reasonably demonstrate is achievable by the alteration.

1. For a technical requirement which did not exist when a generators agreed GPS was established,
  - A generating system should not be required to negotiate GPS for the clauses that are not affected by the alteration;
  - A generating system shall capture performance for clauses which ARE affected by the alteration, where practical based on readily available information and studies produced within the scope of the alteration.
2. Where independent assessment of existing and new generating units is possible, any assessment of performance should be on new units (and existing units will not require updated GPS).
3. Any generating system which is required to update or establish its GPS should be accompanied by a suitable generator model, where a model is deemed necessary to assess the technical requirements which are impacted by the alteration.

## **Performance meeting agreed GPS**

5. AEMO and the NSP will accept Performance standards under NER 5.3.10 for generating plant that is altered, subject to confirmation that there is no overall degradation to the power system resulting from the generator system alteration.

## **Performance above agreed GPS**

6. AEMO and the NSP will accept Performance standards under NER 5.3.10 for generating plant that is altered, subject to confirmation that there is no overall degradation to the power system resulting from the generator system alteration.
7. Where improved performance is the result of an alteration which was intended to improve performance, the improved performance should be captured in an updated GPS so that the power system is operated on accurate and up-to-date performance data that can be relied on by AEMO and NSPs.

## **Performance below agreed GPS**

8. Acceptance by AEMO and the NSP under NER 5.3.10 of Performance standards for generating plant which are altered below existing agreed GPS (for example moving from grid following to grid forming inverters), will be based on engineering judgement by AEMO and the NSP, where the alteration does not result in an overall degradation to the power system and is above the MAS which was applicable at the time the performance standards were originally established.

The above intent and principles have been adjusted based on TWG feedback. Alterations made since the workshops are outlined in Appendix 7 -

### 7.3 Recommendation 2 - AEMO develop a Generator Alteration Framework.

Extending, and potentially superseding the fact sheet at Recommendation 1, is the development of a detailed Generator Alteration Framework. This framework is proposed to be a structured, phased approach to prepare and provide an overarching suite of guidance and tools to help proponents through a generator alteration from end-to-end.

A key element of the framework is the preparation of detailed generator alteration guidance. The guidance would be published and maintained by AEMO (in consultation with industry) and developed through consultation with and input from NSPs and other industry participants.

Akin to the Registration and Alteration of a Generating System – Sugar Mill - Fact Sheet<sup>2</sup> published by AEMO in July 2023, this recommendation would see a similar, although more extensive document developed addressing the NER 5.3.9 process.

It is important to note Clutch is not recommending this guidance take the form of an NER mandated Guideline. It was not clear from workshops there would be significant benefit, nor need of having an NER mandated NER 5.3.9 Guideline.

However, Clutch suggests AEMO further considers the merits/necessity of an NER Guideline as part of the later continuous improvement phase of the Generator Alteration Framework.

In summary, the Generator Alteration Framework would be:

- Supplemented with online tools to help educate participants on the relevant and appropriate generator alteration processes and to assist them to self-diagnose the most appropriate alteration scenario and associated process for their situation.
- Supported with communication and training tools to help ensure better participant education on how to undertake a generator alteration.
- Prepared in stages, as shown in Figure 3 below. The purpose of a staged approach is to ensure the industry can take advantage of process improvements quickly, while other phases and recommendations are implemented.

It is also important to note Figure 3 highlights the suggested continuous improvement approach to ensure the guideline and supporting tools are constantly updated to reflect additional alteration scenarios identified, and to include real world case studies where these tools have been utilised. This phase will ensure other ideas for improvements to the generator alteration process are incorporated.

Clutch has prepared the below indicative implementation process for the Generator Alteration Framework. A detailed implementation schedule and project plan outlining the proposed implementation timeframes for the stages of this recommendation is shown in Appendix 6 - .

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<sup>2</sup> [https://aemo.com.au/-/media/files/electricity/nem/network\\_connections/registration-and-alteration-of-a-generating-system-sugar-mill-fact-sheet.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/network_connections/registration-and-alteration-of-a-generating-system-sugar-mill-fact-sheet.pdf?la=en)



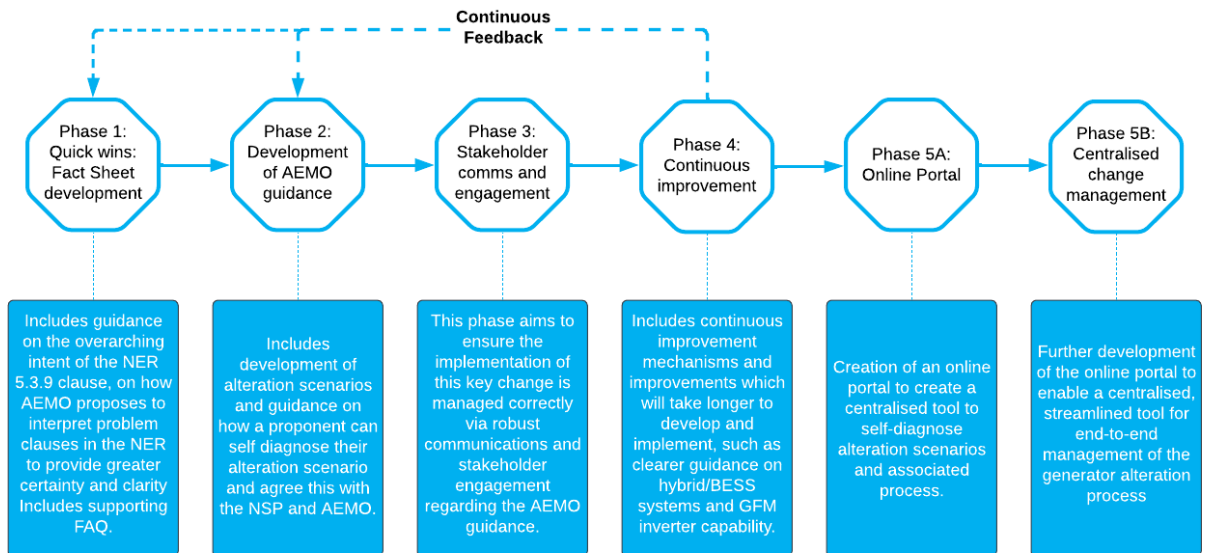


Figure 3 - Phases of AEMO Generator Alteration Framework preparation

The high-level approach within each of the development phases of the AEMO Generator Alteration Framework as described below. Clutch has prepared initial high level project plans which provide a more extensive breakdown of the phases and to support the development of the AEMO guidance. These can be provided if needed.

### 7.3.1 Phase 1 – Quick wins: Fact Sheet with supporting FAQ.

This phase involves a near term development and roll out of an AEMO Fact Sheet and FAQ document, providing information to proponents on those areas which can be resolved quickly (such as greater clarity on the intent of the application NER 5.3.9 before any rule changes can be progressed). These are quick wins, aimed at ensuring immediate improvements are implemented where possible. This phase is also aimed at addressing various CRI guiding questions shown in Appendix 8 -

Key takeaways from TWG participants, which Clutch recommends are included in this phase include:

- a title to the effect of **“Making an alteration to a generating system”**. This will help with the perception that there are various alteration pathways in addition to NER 5.3.9 which might be more appropriate depending on the alteration scenario;
- an explanation of AEMO’s intent in applying NER 5.3.9, to give effect to the recommended intent and principles from Recommendation 1;
- an explanation to clarify that it is not AEMO’s intent to request proponents increase performance to meet the new AAS as part of a generator alteration process, but rather to ensure the generator remains compliant with its established performance standards, or to establish updated performance standards where appropriate. This will deal with issues caused by reference to 5.3.9(b)(3) in clause 5.3.4A(b1) in advance of any rule change process as part of Recommendation 3 discussed later (to address guiding questions 3, 5 and 9 shown in Appendix 8 -
- a clarifying statement to detail that any performance requirements which did not exist when a generator first established its performance standards are only applicable to any new generation/capacity added (for example where a BESS is added behind a legacy plant connection point). Existing legacy generation is not required to meet new performance requirements unless such generation is being altered specifically to meet a new requirement (to address guiding question 9 shown in Appendix 8 -
- A description of the circumstances where AEMO and NSPs may allow performance to be reduced, where such performance reduction:

- does not adversely impact on the power system;
  - is appropriate given the nature of the alteration;
  - is still above the MAS applicable at the time the generator established its performance standards; and
  - is appropriate given local power system conditions.
- Guidance on transitioning from GFL to GFM inverter capability, including those performance areas which AEMO acknowledge are likely to be reduced and those expected to improve. This should align with and complement AEMO's existing "Grid Forming BESS connection fact sheet"<sup>3</sup>. An example here would be going from GFL with 4% Iq injection to GFM with lower Iq injection (since they have different ways to respond to faults). This should not be considered a performance reduction.
  - guidance noting the onus will be on the applicant to provide quality, correct data and models when undertaking an alteration.
  - information detailing the importance of ensuring proponents engage with the relevant NSP and AEMO early to discuss the specifics of their proposed alteration;
  - Guidance on where minor design changes during R1 phase are not considered problematic and are therefore acceptable.
  - Outline the intent to apply the 5.3.4A process timeframes to NER 5.3.9 reviews (to address guiding question 4 shown in Appendix 8 -
  - a general FAQ flagging NER 5.3.9 isn't the only alteration mechanism, i.e.:

Q: I am altering my generating system. Do I need to follow the NER 5.3.9 process?

A: Not necessarily. Depending on the specific alteration scenario, there may be a more appropriate alteration mechanism. Talk to your NSP who will help define the most appropriate pathway.

### 7.3.2 Phase 2 – Development of AEMO guidance

This phase involves medium term guidance, building on the near-term 'quick wins' to provide additional support in areas which will require further work beyond when initial FAQ is to be published.

Clutch recommends this phase involves the creation of a checklist and decision tree to support proponent 'self-diagnosis' of the alteration scenario and process to be followed, creating greater proponent education, awareness and accountability.

Indicative considerations for development of the checklist and decision tree are shown in Figure 4, including input from industry stakeholders.

This phase will identify the most common alteration scenarios, the associated characteristics of each scenario and the questions a proponent should ask themselves to help define the most applicable alteration processes for their scenario.

The intention of this phase is to provide clear tools for proponents to self-diagnose their alteration scenario and the appropriate process (including alternative NER pathways where appropriate), and to create the mechanisms to agree the scenario and associated process with the NSP and AEMO.

This will help improve proponent understanding and provide greater clarity and consistency in NER 5.3.9 application.

This phase is also aimed at addressing various CRI guiding questions shown in Appendix 8 -

<sup>3</sup> [https://aemo.com.au/-/media/files/electricity/nem/network\\_connections/grid-forming-bess-connection-fact-sheet.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/network_connections/grid-forming-bess-connection-fact-sheet.pdf?la=en)

Clutch recommends the following are included in this phase (which includes areas highlighted in TWG workshop discussions):

- Definition of:
  - key alteration scenarios;
  - the key characteristics of each scenario which will help group scenarios;
  - the key questions Proponents will need to ask to determine whether their alteration is a particular scenario;
  - a decision tree and checklist to assist proponents in 'self-diagnosis' of which scenario applies for a given alteration, based on the identified scenarios and their associated characteristics determined in above steps. This will effectively create a triage process to ensure a correct and consistent approach to handling different alteration scenarios (addressing guiding questions 1, 2, 4 and 6 shown in Appendix 8 -
  - the key alteration processes (high level inputs & outputs / process / scope and requirements / clauses impacted / indicative time frames) which should apply for the groups of scenarios, including process applicable to the various NER alteration provisions outlined in section 2.3.2 (addressing guiding questions 1, 2, 4 and 6 shown in Appendix 8 -
  -
- guidance on pre-screening alteration scenarios to determine those scenarios which can be implemented outside of any alteration process.
- Development of technical note templates to guide Participants in preparing the appropriate detail for the different alteration processes specified in Phase 2.
- guidance around the philosophy in applying engineering judgement and pragmatic decision making, along with some "worked examples", noting this should not be too rigid.
- Definition of a facilitated review mechanism (independent engineering expert) to manage disagreements or misalignments in the requirements under a specific alteration application. This may leverage similar existing processes within the NER such as that laid out in NER 5.4.
- guidance for including BESS (or hybrid systems) behind a single connection point with legacy generation. This should include guidance on separating the new and legacy plant for the purposes of performance assessment where possible, or combining performance where necessary. Ideally AEMO should also establish a new framework for separating POCs for the purpose of assessing and measuring performance, perhaps allowing POC within the facility rather than the common interface point with the network.

Additional considerations for implementation of this phase are provided in the high-level project plan shown in Appendix 4 - .

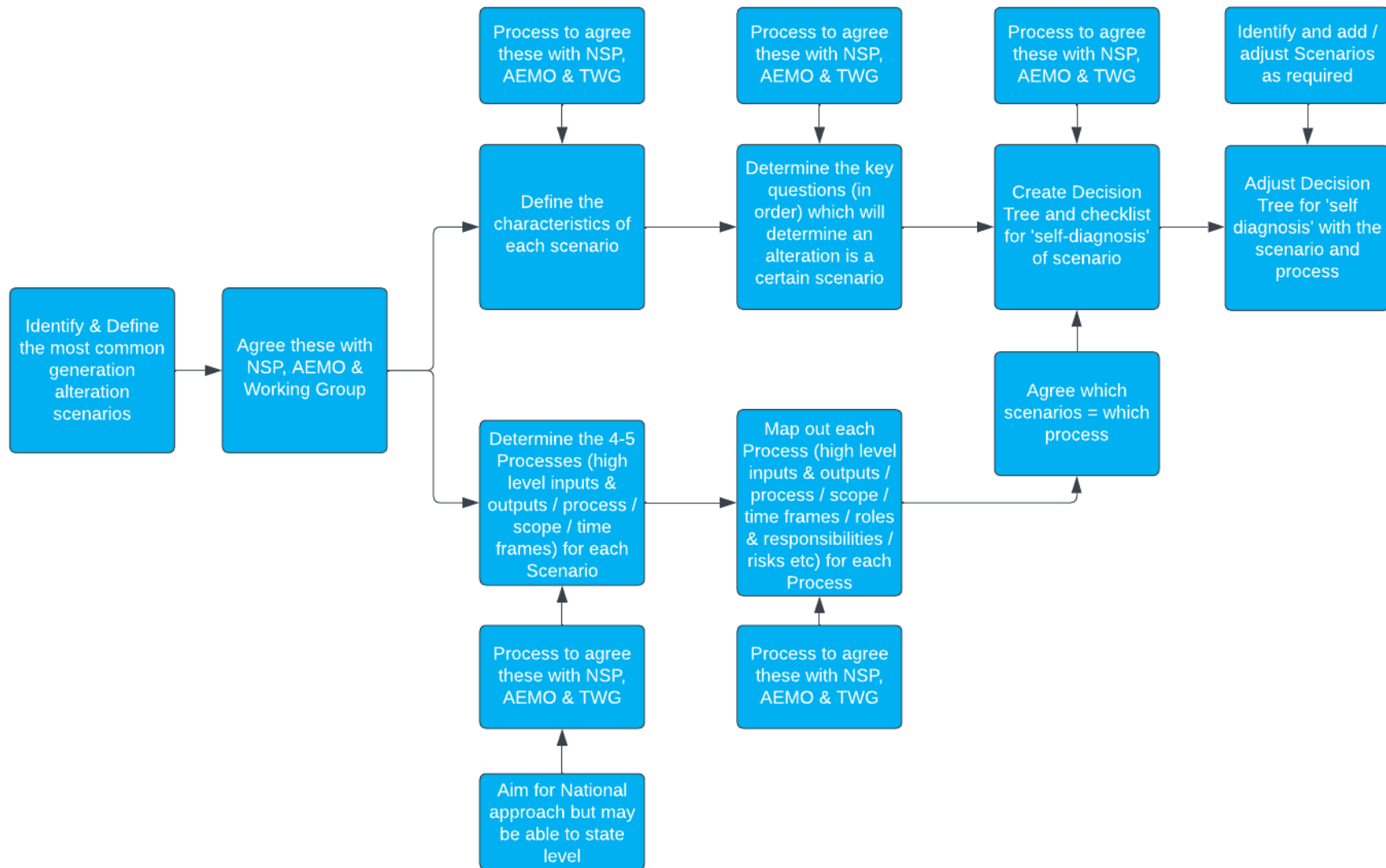


Figure 4 - Generator alteration checklist and decision tree development process

### 7.3.3 Phase 3 – Stakeholder communications and engagement

This phase aims to ensure the hard work which has gone into preparation of the AEMO guideline achieves maximum benefit by a concerted effort on implementation. This phase aims to map out areas to ensure the guideline is well implemented, the guideline development is appropriately communicated to industry and appropriate training is offered to participants in the NEM.

In considering TWG feedback, Clutch recommends this phase incorporate:

- seminars/forums to communicate the details of the published guideline and as an opportunity for participants to ask questions and provide feedback as necessary. Forum should include workshopping some worked examples to demonstrate usage and provide opportunity for participants to ask questions.
- training programs/courses to train participants on use of the guidance and tools developed during phase 2.

Training should include:

- an overview of the typical alteration scenarios and typical process for each scenario;
- an overview of required inputs for each scenario and process;
- Support to use self-diagnosis tools and assessing which scenarios is applicable to a proponent's alteration;
- worked examples on scenarios and on application of engineering judgement as well as some scenarios which might be considered to have a material impact (to provide some indication to proponents upfront, noting a pre-determined list will not be exhaustive) and should not be too prescriptive to allow flexibility to appropriately apply engineering judgement to specific circumstances.
- expectations around typical timing to process alterations under different scenarios; and
- support to NSPs and AEMO personnel around the application of engineering judgement and balancing the needs of the system with the impacts to proponents.

### 7.3.4 Phase 4 – Continuous improvement

This phase aims to include mechanisms to ensure the AEMO guideline is improved as necessary and incorporates learnings from real alteration situations. This ongoing process will also be critical in adapting the guideline as new technology, lessons learnt, and scenarios are encountered. This phase will include additional support for scenarios which may require significant work before guideline can be updated accordingly.

Clutch recommends this phase include;

- an overarching framework for guideline review and updates;
- feedback mechanisms to ensure proponents and other stakeholders can provide feedback at any time;
- a published list of alteration applications and the applicable scenarios/process, as defined using the AEMO guidance tools. Clutch envisages this as being akin to the reporting undertaken by AEMO in the connection scorecard;
- Capture any additional scenarios and associated processes which AEMO may not have considered within the guideline initially;

- additional guidance on AEMO/NSP driven alterations and how they should be treated outside of the NER 5.3.9 process;

### **7.3.5 Phase 5A – Online portal - Guideline**

This phase will largely replicate the guideline in an online tool. It is proposed proponents will be able to self-diagnose and plan for the NER 5.3.9 process utilising this portal rather than a static guideline environment. The self-diagnosis decision tree and supporting deliverables and outputs can be stored and maintained within this portal which will provide a single source of the truth for the most up to date guidance material and approach.

### **7.3.6 Phase 5B – Centralised change management**

This phase will require much more effort in terms of development and implementation. This phase would aim to centralise all elements of a generator alteration by providing online platforms to manage the end-to-end generator alteration process, incorporating the ability to manage inputs and outputs, communications, approvals etc all within a centralised tool.

### 7.3.7 Recommended end-to-end generator alteration process

Based on the recommendations proposed by Clutch within this Recommendation 2, Clutch has developed a generator alteration process flow which is intended to demonstrate the steps in using the tools developed to arrive at an appropriate and tailored generator alteration outcome. This process is shown in Figure 5, which demonstrates the approach to using the tools developed under Recommendation 2 to determine the most appropriate alteration scenario and process, and Figure 6, provides an indicative process flow once the correct alteration process is agreed with the NSP and AEMO.

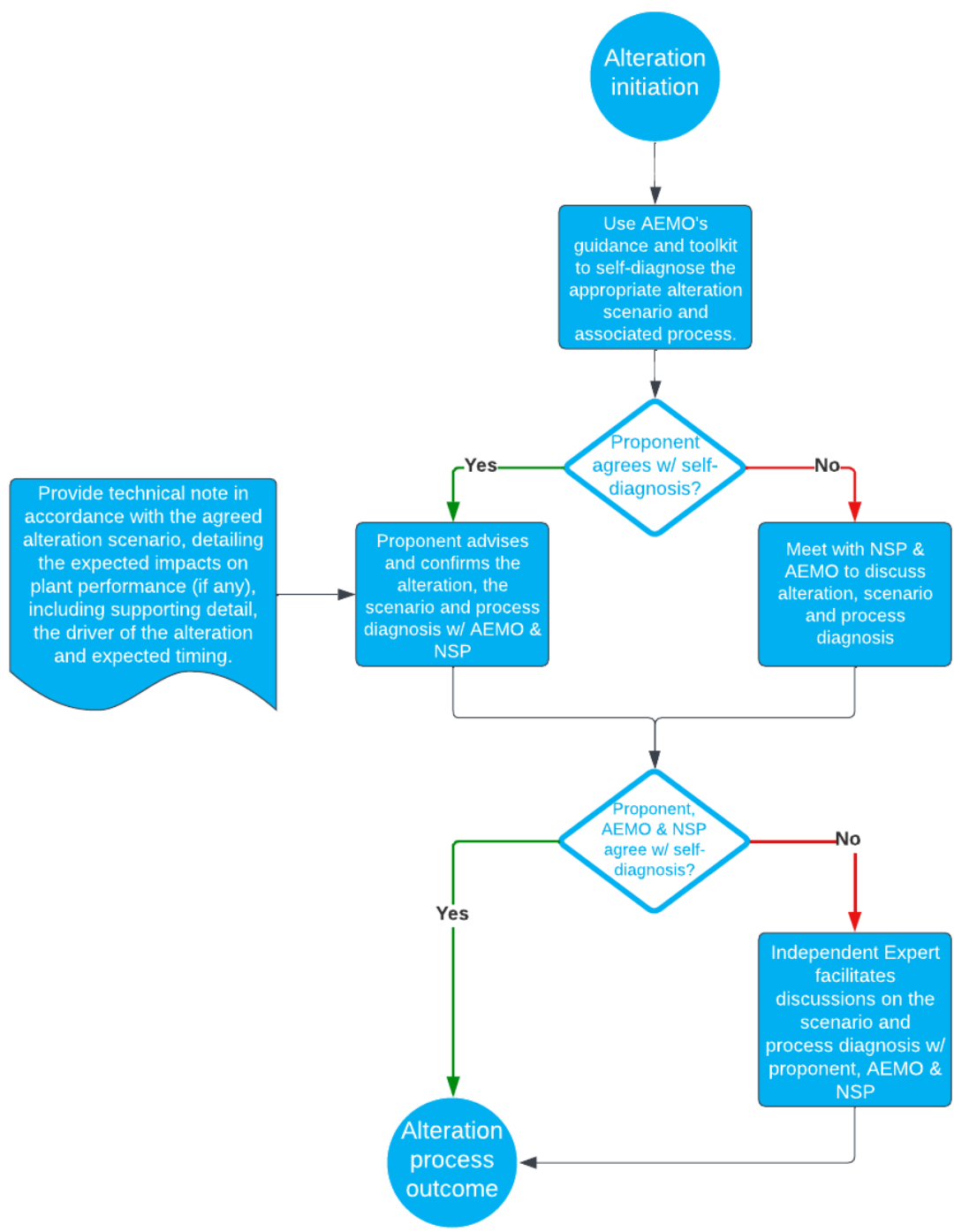


Figure 5 - Proponent self-diagnosis process



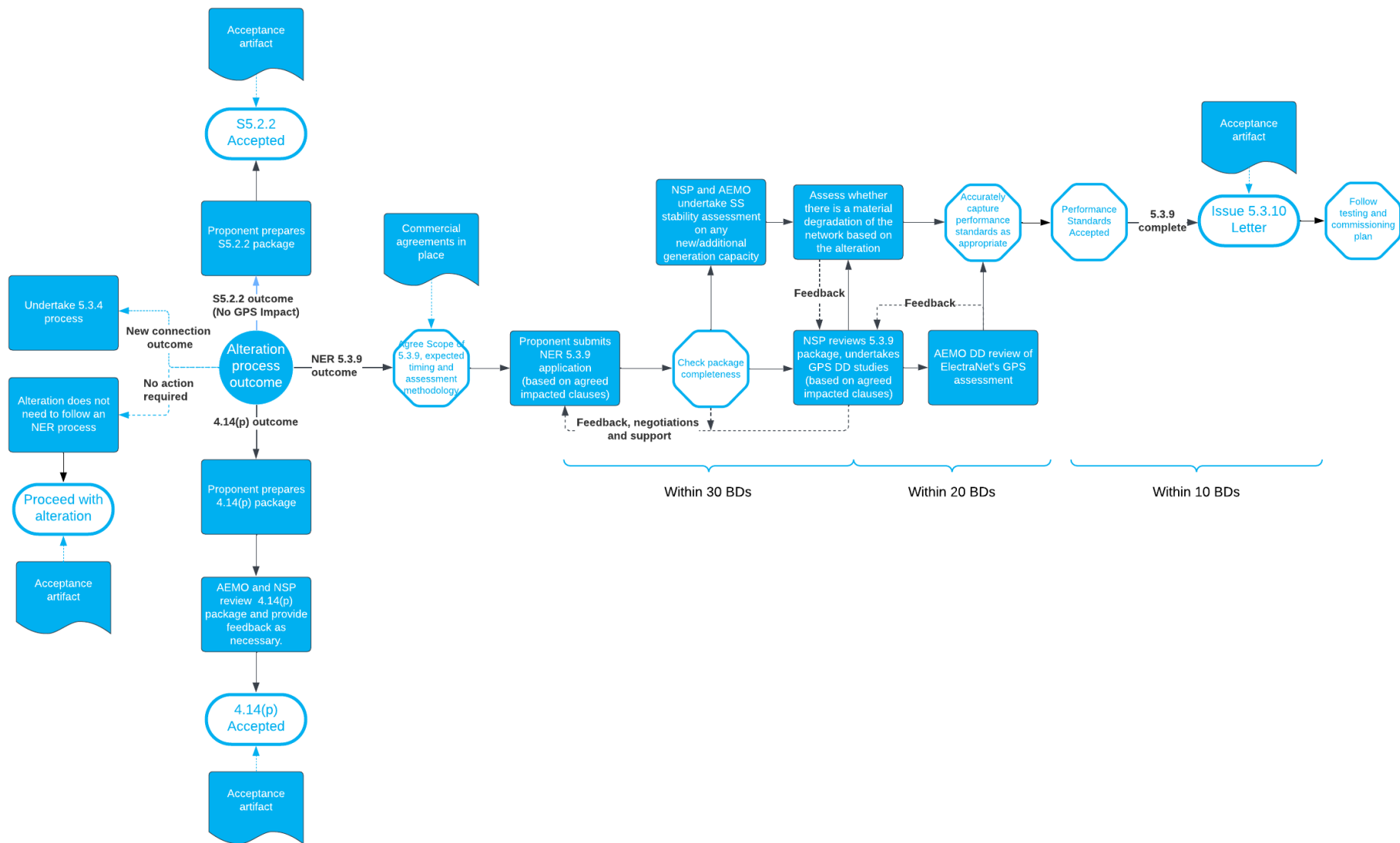


Figure 6 - Generator alteration process flow

## 7.4 Recommendation 3 – Amendments to the NER

To support the recommended intent and guiding principles as listed at Recommendation 1, this recommendation proposes amendments to the NER. The recommended changes remove the onerous requirements of NER 5.3.4A against generator alteration proposals under NER 5.3.9, as NER 5.3.4A does not align with the overarching intent of the NER 5.3.9 process. These NER changes were strongly supported by the TWG during workshop 6 and address issues raised various CRI guiding questions shown in Appendix 8 -

The recommended amendments are listed in the table below:

Clause	Task
5.3.4A(b)(1A)	Delete provision in 5.3.4A(b)(1A) which provides that a negotiated access standard pertaining to NER 5.3.9 be no less onerous than the existing performance standard.  This is to allow reduced performance against a negotiated access standard where that reduction is appropriate.
A new clause, likely near 5.3.4A(b)(1A)	Insert a clause which gives effect to the ability to reduce performance where appropriate, based on engineering judgement and given the type of generating technology, the size of the generator, the needs of the system at the location where the generator is connected and when there is no material adverse impact to the power system.  Noting this should be at the discretion of the NSP and AEMO and should not be about reducing performance as a starting point but rather is based on the nature of the alteration.  This clause should ensure altered performance is no less onerous than the lower of the MAS which existed at the time the generator first established its GPS, and the existing agreed level of performance.
5.3.4A(b)(1)	Delete reference to subparagraph 1A.
5.3.4A(b1)	Delete the reference to 5.3.9(b)(3) in clause 5.3.4A(b1) to remove any requirement to propose a standard as close as practical to the AAS when making an alteration to a generating system.

This recommendation should be progressed in parallel with the development of the Generator Alteration Framework as per Recommendation 2, as the two recommendations are complementary.

### 7.4.1 Risk

In forming this recommendation, Clutch assessed the risk that these changes may inadvertently become a loophole or disincentivise the intent of 5.3.4A and/or 5.3.9.

The highest risk scenario identified was that these amendments would create a mechanism for connecting parties to sign up to standards that would not be achievable, with a view of reducing performance later under NER 5.3.9. Or, that parties will seek connection of low-quality assets, transferring risk onto other parties later.

Having considered the broader NER, Clutch assessed that there are sufficient safeguards within the current NER and connections processes (such as the requirement to specify performance as close as possible to AAS under an NER 5.3.4A connection process) to ensure proponents do not push costs/risks to other parties by establishing poorly designed plant.

## 7.5 Recommendation 4 – Treatment of alterations between NER 5.3.4 approval and R2

As noted at Recommendation 3, changes to NER 5.3.4 are proposed to alleviate limitations on the NER 5.3.9 process.

This review identified that further changes are necessary to support NER 5.3.9, but that these changes are and already contained in, and proposed by, the 'Enhancing investment certainty in the R1 process' rule change request, as submitted by CEC.

As this rule change request is currently under review, it was considered prudent to recommend that this active request be allowed to resolve unhindered; and at its conclusion a further supplementary review of the effect on NER 5.3.9 be undertaken.

It is Clutch's view that the 'Enhancing investment certainty in the R1 process' rule change request will result in all the necessary amendments to clarify and support the treatment of alterations during the R1 phase (such as the ability to agree reduced performance where a design change during the R1 phase results in a reduction from the agreed GPS).

### 7.5.1 Expectations of Outcome

The challenges experienced in the application of the NER 5.3.9 process to the R1 phase of the connection process, between NER 5.3.4 approval and generator registration, will be resolved if:

- The proposed changes to NER 5.3.4A recommended in this report are implemented in full,
- The complementary recommendations outlined in this report are implemented in full, and
- Some complementary solutions outlined in the CEC's rule change request are implemented (including suggested amendments to NER 5.3.4A and the establishment of a new concept of materiality for assessment of the R1 modelled performance of a plant, against the negotiated access standard).

Noting these expectations of outcome, no additional recommendations specifically targeted to this R1 phase of the connection process are made in this report.

It is recommended that on conclusion of the extant rule change request, regardless of the extent to which the above listed outcomes are achieved, that a supplementary review on the impact to the application of NER 5.3.9 during the R1 phase be undertaken.

This limited scope review would ensure that any impacts to NER 5.3.9 are noted and clarified, and further specific recommendations can be made. This would include updates to the fact-sheet and framework as described at Recommendations 1 and 2.

## 7.6 Recommendation 5 – Support for legacy plant modelling

As noted in the findings 'Best Practices', any Proponent seeking to apply the NER 5.3.9 process must have a working, representative model of the generation facility.

The review found that a number of facilities on the network have simplified or no representative facility models. As such, these facilities in the NEM will be limited, or possibly unable, to undertake a generator alteration under NER 5.3.9. This presents a significant impediment to the timely and efficient evolution of the network.

For proponents with such facilities, obtaining more detailed representative models of their facilities may have considerable time and costs implications. Nonetheless, positive upgrades and changes to these facilities may provide considerable benefits to the market so these changes should not be unnecessarily discouraged.

It is Clutch's position that the PSMG provides sufficient detail to support proponents in the development of appropriate facility models for legacy plant. The PSMG and its various model development pathways (including support available via alternative processes outlined within sections 4.8.4 and 8 of the PSMG) should be leveraged to support model development for alteration scenarios under NER 5.3.9.

This recommendation focuses on supporting proponents in identifying and applying the relevant sections of the PSMG and how AEMO can support the development of a model appropriate to a given alteration scenario.

Referring again to the 'Best Practices', effective and early communication and cooperation between proponents, NSPs and AEMO is a key enabler to the success of the NER 5.3.9 process.

This recommendation proposes that AEMO take a leading role to educate and support facilities to be 'alteration ready', or at a minimum 'alteration aware'. The table below details several actions which AEMO should lead, in consultation with the NSPs in each jurisdiction, with the view of educating and mobilising proponents to prepare plant models, should they be considering plant alterations.

Clutch considers this recommendation should be actioned in the first quarter of calendar year 2024.

Task
identify legacy plant on the NEM which does not currently have suitable representative models of their facilities, as required by the latest PSMG.
Write to the owners of those facilities, notifying them of the requirements within the latest PSMG and informing them that if they are considering an alteration to their generating facility, they should proactively prepare suitable generator models. Note, it is only recommending models be developed for legacy plant undertaking an alteration process. It is not Clutch's recommendation that all legacy plant on the NEM must prepare facility models.
Define the level of support AEMO and the NSPs can offer in preparing models for plant in accordance with section 4.8.4 of the PSMG and the alternative pathways for the proponent to apply to provide alternative modelling and information, as set by Section 8.3 and 8.4 of the PSMG.  This should define the requirements for models for legacy plant if retrofitting energy storage for example, to ensure that only the elements of the model of the legacy plant needed to assess interactions with the BESS are required, i.e. a pragmatic approach to model development is requested, noting the intent of the addition of a BESS is not to alter performance of the legacy plant and noting the principle within the PSMG that the model requirements should not present an unnecessary deterrent to augmentation works that are likely to benefit the power system.  This process should also better define a pathway for developing models using test results and/or operational data.
Proactive communications to proponents to encourage them to contact AEMO to discuss their scenario and the information available to prepare a model and align with AEMO on expectations and requirements should the proponent be considering an alteration.
AEMO to provide advice to proponents to proactively prepare suitable generator models for their facilities if considering an alteration (for such alterations as will likely require updated model) in accordance with the PSMG, as appropriate for their particular alteration scenario.

## 7.7 Recommendation outside of review scope

The following opportunity is presented for AEMO and/or NSPs to consider in the fullness of time - once the recommendations of this review are implemented.

### 7.7.1 Establishment of generator alterations working group

Clutch considers there may be merit in establishing a generator alteration working group.

This working group would provide advice to NSPs, AEMO and the proponent where there is a disagreement on the scope of studies and assessment. The purpose of the working group would be to provide advice about the most appropriate approach for a given alteration, taking account of the nature of the alteration, the intent of the alteration, the materiality of system impact of the alteration, the location where the generator is connected and the time and cost impact to the proponent.

Such a working group could be made up of two consistent members from AEMO, two consistent members from registered NSPs as well as a floating member from the connecting NSP, for example.

This working group would provide consistency in application of the various alteration treatments by considering more holistically how similar alterations have been treated previously, while bringing system level experience and an appreciation of the risks and impacts on generation proponents.

Clutch suggests this could be a specific body tasked with supporting the generator alteration processes and would be convened as required. This approach would be ultimately implemented to replace the engineering expert approach outlined earlier.

Clutch recommends that AEMO further test the merits and practicality of this approach with NSPs, as a follow-on opportunity to strengthen the NER 5.3.9 process once the recommendations of this review are implemented.

## 8 Conclusion

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This review has confirmed that NER 5.3.9, as written and applied, is not working effectively for proponents, NSPs, AEMO or the broader community.

As the energy market continues to evolve and adapt to new technologies, notably the growth of renewable energy generation, NER 5.3.9 stands as an obstacle to the efficient alteration to connected generators.

While NER 5.3.9 is a vital clause, ensuring the grid remains safe and stable, it lacks detail and clarity, which is adversely impacting the ability of proponents to adapt and implement generator alterations which would bring net benefit to the system.

The implementation of the recommendations provided, will support industry to make efficient and timely alterations to connected facilities, ensuring that the grid can grow and evolve to meet the needs of the energy transition.

- Recommendations 1, 4, & 5, are entirely within the capacity of AEMO to implement in the near term, with minimal cost.
- Recommendation 2 can be implemented in a staged manner, with the production of a fact sheet and supporting FAQ within the capacity of AEMO to implement in the near term. Production of the broader Framework and associated guidance is a larger effort, but achievable within the medium term. This recommendation would provide the most significant benefit to industry, and well within the capacity of AEMO to implement.
- Recommendation 3 will require more significant industry consultation, but its intent has precedence in the recent rule change request by CEC, seeking similar outcomes.

The recommendations of this review are well within the capability of industry, led by AEMO, to implement over the near-term, and will provide a significant benefit to the NEM connections process, while allowing for continuous improvement over time.

# Appendix 1 - Workshop outcomes

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## Workshop 1 – NSP / AEMO perspectives

Workshop 1 focussed on gaining an understanding from NSP and AEMO representatives on their understanding of the critical issues with the NER 5.3.9 process. This workshop also aimed to understand, from an AEMO and NSP perspectives, what inputs and process requirements are critical. The purpose of this was to define any ‘must-haves’ for any NER 5.3.9 process redefinition

### Top key issues identified

What we heard from workshop 1 was clear alignment on key issues associated with the way the NER 5.3.9 process is currently being implemented.

**Flexibility** – to tailor NER 5.3.9 process to specific circumstances.

**Clarity and transparency** – of process and approach to improve clarity and transparency for participants.

**Further consideration required for legacy plants** – how are they to be treated under this process having regard to their GPS (registered under old Rules) and applicable assessment requirements.

### Process clarity and transparency

During workshop 1, stakeholders agreed there were significant issues with the clarity and transparency associated with the NER 5.3.9 process. Key points raised in this workshop included:

- Stakeholders agreed there should be clarification over which pathway participants should take when proposing to alter a generating system. NSPs/AEMO could provide participants a clearer explanation of the relevant NER requirements, required process and documentation.
- Educating participants on the alternative NER pathways and the application will provide transparency and certainty to participants, and this will also reduce the need for case-by-case explanation from NSPs / AEMO. This should assist the participants to be better prepared and have reasonable expectations of process requirements.
- NSP/AEMO guidance and development of joint scopes can be better informed if the participant provides clear documentation on the details of alteration and the impact of the alteration (from their perspective).
- Individual proposals under an NER 5.3.9 should be underpinned by an overarching schedule, methodology and scope which can be confirmed and agreed with a participant prior to project commencement (and confirmed at a kick-off meeting).
- There is an opportunity for NSPs and AEMO to better substantiate additional issues identified and why additional scope is necessary, supporting improved transparency of process and approach.
- A documented scope and approach could provide greater transparency and reduce variations in a given process, which could arise from change in personnel, as well as the actual outcomes of the studies / due diligence.
- A clear (but not exhaustive) list of common factors which drive the need for assessment under NER 5.3.9 should be documented. For example, factors which clearly impact something within the network or impact on system strength and require a Full Impact Assessment (FIA).



### **Expected timeframes clarity and transparency**

- There is significant value in participants providing a clear and accurate statement under an NER 5.3.9 application on what the proposed generating system alterations are, the specific performance standards which the alteration will impact and the nature of said impact.
- Lack of communication from NSPs/AEMO on NER 5.3.9 process results in participants being disappointed with timeframes.
- NER 5.3.4A timeframes could be made applicable to the assessment processes under NER 5.3.9.
- Providing an indicative schedule for example timelines of the process could provide participants with greater certainty and understanding.
- Participants can influence/reduce timeframes with higher quality information being provided at the start of the process.

### **Flexibility to tailor approach**

- Further work is required from NSPs and AEMO to confirm and agree what impact this process will have on generating system alterations involving batteries, which are intending to take advantage of grid forming technologies (as an example of common future occurrence). i.e. NSPs and AEMO acknowledge the potential value in incorporating grid forming capability, so there is value in understanding how this can be streamlined through the NER 5.3.9 process.
- Participants could benefit from improved flexibility from NSPs and AEMO to agree to reduced performance (under NER 5.3.9) where there might be other benefits/trade-offs in performance or where there is no network impact.
- NSPs and AEMO may be open to an approach where legacy plant is not be exposed to new, more onerous NER performance requirements (where modifying plant or adding a BESS for example), subject to maintaining compliance with established requirements. It will however be valuable to measure and record (but not assess) the performance against new NER requirements, where possible.
- Providing participants with a list of different circumstances or examples of the specific treatments/approaches which are appropriate based on a typical set of circumstances, will provide greater transparency and certainty in the process:
  - This cannot be an exhaustive list but should capture key scenarios that have been observed where a generating system may have been treated differently due to its circumstances, relative to the typically observed NER 5.3.9 approach.
- NER regulatory requirements do not always permit the flexibility which NSPs/AEMO may be open to. Rule changes may be required to enable this.

### **Treatment of new vs legacy plant**

- To date, NSPs and AEMO have used a library of models for assessing unmodeled generating systems. This may not be appropriate for future NER 5.3.9 purposes:
  - Accurate models (in particular PSCAD models) typically require OEM support to get right.

- Participants must have a working PSCAD model (or agree to a generic/library alternative).
  - Where possible, legacy plant to prepare a PSCAD model if undertaking an NER 5.3.9 process (i.e. be proactive in model preparation).
  - Is there a possibility for NSPs/AEMO to create a library of models for assessing unmodeled facilities, to support those facilities which cannot prepare their own models. The costs and benefits of this approach, as well as who pays for this initiative, requires further development.
- Providing participants, who want to include a BESS for their project, with a clear list of what will be examined and why this process will be undertaken.
  - New plant must be assessed against latest version of the rules, however performance level benchmark is previous GPS.
  - Legacy plant to be assessed against their GPS registered under old Rules, however, performance against new standards to be captured and documented where possible (even if not assessed).

### **Must Haves**

Throughout the discussions of workshop 1, the NSPs and AEMO noted several ‘must-haves’ for consideration by proponents who are seeking to make an alteration to a generating system. These included:

- If participants are making a generator alteration which will impact on performance, participants must have a working PSCAD model (or agree to a generic/library alternative) to accurately assess the impacts of the alteration on the generating system and the power system.
- NSPs and AEMO must have the ability to modify the scope of the studies by the participant or due diligence studies deem it necessary.
- New plant must be assessed against the latest version of the rules, however but performance level benchmark is the previously agreed GPS, not the latest.
- Legacy plant to be assessed against their GPS registered under old Rules, however, performance against new standards to be captured and documented where possible (even if not assessed).

## **Workshop 2 – Test and align key outcomes from workshop 1**

### **Share perspectives on effective elements of the current NER 5.3.9 Process**

#### **Discussion points and key takeaways**

In addition to those elements identified during Workshop 1, attendees noted the following are effective elements of the current NER 5.3.9:

- Detailed and accurate alteration proposal:  
When proponents are well prepared and have a clearly presented plan detailing what is proposed to be altered and what the associated impacts are. In such cases, the process has worked well with little to no surprises.
- Realising benefits of alterations framework:  
General agreement that the overall NER 5.3.9 is a useful change management process as AEMO, NSPs and participants don’t want to see uncontrolled change.
- Avoidance of full GPS where feasible:

There have been instances where NER 5.3.9 has been practically and pragmatically applied and there hasn't been a need for a full GPS reassessment.

Harmonic filters, for example, have at times progressed through the NER 5.3.9 Process relatively smoothly where the impact of adding the filter is minimal and the filter is acknowledged as sensible inclusion when required.

- Leveraging learnings:

There are examples of copy/repeat applications by the same developers for multiple generators of different participants across different jurisdictions, where it has worked well for one generator and can be pragmatically repeated elsewhere.

### **Understand the 'must-haves' in the current NER 5.3.9 Process**

#### **Discussion points and key takeaways**

There were no objections raised to the 'must-haves' outlined during Workshop 1.

In addition to those elements identified during Workshop 1, attendees at Workshop 2 proposed the following 'must-haves' for an effective NER 5.3.9 Process:

- Detailed and evidenced proposal with impacts identified:  
Proponents must clearly define any proposed generator alterations and the associated impacts of the change, with adequate studies and evidence to accompany an application under NER 5.3.9.
- Reasonable application of discretion to NER 5.3.9:  
TNSPs and AEMO must have a discretionary/reasonableness approach when assessing an application under NER 5.3.9.
- Consideration of NER 5.3.9 process impacts and alteration benefits:  
TNSPs and AEMO must have an appreciation for the commercial impacts of NER 5.3.9 uncertainty as well as the potential benefits to the system of generator alterations under NER 5.3.9 - i.e. when a grid forming BESS is added to existing plant and improves overall generator capability.
- New plant subject to current NER requirements:  
New plant (i.e. addition of a BESS) must come under the version of the NER which is current at the time of the plant progressing through the NER 5.3.9 Process.

### **Align on the 'Top 3-5' critical issues with the current NER 5.3.9 Process**

#### **Discussion points and key takeaways**

The most common issues identified during Workshop 2 include:

- The lack of certainty and clarity around the NER 5.3.9 Process. Specific examples raised were:  
Uncertainty has caused some developers to avoid implementing generator improvements which could be beneficial to the overall system.  
A lack of clarity as to whether a generator alteration triggers a requirement to increase performance and meet the Automatic Access Standards (AAS) under the current NER at the time the generator is proposed to be altered.  
A lack of clarity as to whether a generator must meet new standards which were not in place when the generator's performance standards were first registered.
- The lack of flexibility to reduce performance with respect to a particular agreed performance standard(s) where there might be an improvement in performance in other standard(s), an overall performance improvement, or a system benefit resulting from the generator alteration.
- There is a lack of a clearly defined exit from the NER 5.3.9 Process in the case of:

A proponent no longer wishing to proceed with an NER 5.3.9 application; or  
It is determined an alteration has no impact on performance.

### **Identify and refine potentially feasible preliminary solutions to agreed critical issues**

#### **Discussion points and key takeaways.**

High level preliminary solutions to the key issues identified during Workshop 2 are presented below. While the feasibility of these solutions will need to be further tested from NSP/AEMO and generator/developer perspectives, the following are provided for further consideration:

- **Technical note guidance:**  
Guidance on what constitutes a quality technical note and supporting information to validate the nature of the generator alteration and its impacts.
- **Applicable NER technical requirements:**  
Importance of clarifying that generator performance does not need to meet new NER version when an NER 5.3.9 Process is triggered (e.g. by considering grandfathering arrangements if and as appropriate).
- **Treatment of performance where technical requirements did not previously exist:**  
Consider mechanisms to log any performance improvements when a legacy generator is altered, without having to enforce a performance improvement where a clause was not relevant when the generators GPS was first registered.
- **Flexibility to reduce performance where appropriate:**  
The requirement for more flexibility to reduce performance against an agreed performance standard, where it might be appropriate based on local system conditions - i.e. with grid getting weaker over time, a high reactive current injection may no longer be appropriate.

### **Workshop 3 – Explore potential solutions to critical NER 5.3.9 issues**

#### **Alignment on overarching purpose of NER 5.3.9**

#### **Discussion points and key takeaways**

- It was generally agreed the NER 5.3.9 is necessary as a change management process. There is a need to capture the updated performance in some way.
- Technical Working Group (TWG) participants questioned, where a generating system alteration is proposed, whether it is sufficient to meet the GPS, or is it the intention of AEMO and NSPs to negotiate an updated GPS corresponding to the NER version applicable at the time?
  - Under the NER, the floor for a performance standard at the time of an alteration is the registered GPS. The appropriateness of the GPS as a floor for future alterations is a key concern for the TWG, with views raised that performance should be permitted to be approved below GPS (see I4)
  - NER 5.3.4A(b1) could be interpreted as requiring proponents to demonstrate that they do not meet the automatic access standard (AAS), despite being able to meet their GPS. There was broad agreement that the NER 5.3.9 process should not be a mechanism for NSPs and AEMO to increase performance to the current AAS.
    - Exposure to a risk of being required to demonstrate that performance is close as practicable to the corresponding AAS can discourage modifications which may provide system benefits.
- The overarching objective of NER 5.3.9 should NOT be to open-up or revisit the GPS to require increased performance beyond what is achieved by the proposed alteration (assuming it meets its GPS).

- Key assessments should be to:
  - assess the impact of the proposed alteration on the performance of the generating system; and
  - assess the post-alteration performance against the relevant GPS, with next steps informed by whether the post-alteration performance is found to result in the same, reduced or improved performance.
- It is difficult to identify one overarching purpose for the NER 5.3.9 process as alterations to generating systems can comprise a diverse range of scenarios. Some high-level scenarios raised during the Workshop which any assessment of the NER 5.3.9 process should consider include:
  - An existing commissioned project which seeks a "like for like" replacement - where same GPS is targeted
  - An augmentation to an existing or pre-Registration plant which will result in a new GPS.
  - E.g. adding additional inverters, turbines to a project or BESS, where a new GPS is required (at the very least, with more MW)
  - "detailed design" changes between the NER 5.3.4 approval and R1 stages
  - A renegotiation of the GPS triggered by the participant, which may be a reduced GPS.
  - Firmware changes on site to match the existing GPS, where such a firmware alteration has an impact on plant performance.
  - Where a benefit to system (such as re-tuning) is identified, but this requires a change in the GPS (e.g., reduced rise time).

#### **I4: Acceptance of performance below GPS where above current NER requirements**

##### **Discussion points and key takeaways**

- NER 5.3.9 poses a barrier for investment within the NEM due to the perceived delays which accompany it.
- It was generally accepted there is an overarching need in relation to the perception a lack of flexibility in the interpretation and/or application of NER 5.3.4A(b)(1A).
  - Currently, the GPS is the floor for performance of the generating system, post-alteration.
  - Participants considered there should be an ability to reduce performance from the GPS, particularly where:
    - there is no stability risk to the system;
    - it provides more flexibility between GPS approval and R1 to capture inevitable changes following design; and
    - it provides an overall benefit to the system despite a reduction in performance against technical requirements (e.g. connection of grid-forming technology).
- TransGrid and AEMO agreed there have been previous projects where they may have been able to apply engineering judgement to accept a reduced level of performance, however, a strict interpretation and application of NER 5.3.4A(b)(1A) has been a barrier to acceptance.
- There were questions as to when NER 5.3.9 applies given that it applies for GPS 'agreed' and doesn't differentiate between standards agreed at NER 5.3.4A or R1.
  - AEMO's view is that that NER 5.3.9 only applies in respect of performance standards for new connections that have been included in a connection agreement. i.e. NER 5.3.9 would not apply to Generators whose access standards have been agreed under NER 5.3.4A during the connection process but are not yet included in a connection agreement.

GPS not yet included in an executed connection agreement are not 'performance standards' for the purposes of NER 5.3.9.

## **I5: Acceptance of performance where current NER requirements didn't exist**

### **Discussion points and key takeaways**

- Broad alignment within the TWG that new generators/plant should meet the latest NER standards which apply at the time of an alteration, however, existing generators should not automatically have a requirement to meet standards that did not exist when the GPS was registered (grandfather performance).
  - However, if plant can readily meet a new NER requirement because of an alteration, without any retuning or additional investment by the proponent, there are likely planning and operational benefits to NSPs and AEMO in capturing this actual performance.
  - Two broad options for capturing performance against new standards include:
    - a non-binding logging/capture of actual performance, which may be within the GPS but not binding on the participant, or captured outside of the formal GPS; or
    - Include the new capability in the revised GPS.
  - benefits of capturing performance outside of GPS requirements include the ability for NSPs and AEMO to incorporate actual performance into models and other assessment used for planning and connections assessments, and potentially operations.
- The way GPS is assessed can change over time. This can result in plant being non-compliant with its GPS if assessed against a different methodology.
- TWG members were concerned at the risk that a proponent wanting to alter a generating system may trigger a requirement to increase performance.
  - General agreement amongst the TWG that the intent (or consequence) of NER 5.3.9 isn't to create work and undertake unnecessary studies, but that it should be to consider the impact of all generator alterations by applying good engineering judgment.
  - As outlined under section 2, the purpose of NER 5.3.9 is not to increase performance, but to ensure an ability to meet the GPS.
- There is a need to establish and agree a framework for joint assessment of existing plant and new BESS behind the same connection point.
  - How do we treat system strength for old plant if new plant is being held to a new standard?
  - Can the performance of the generators be ring fenced appropriately?
- There is not necessarily a difference between R1 and NER 5.3.9 processes. The required studies under either may differ, however, performance needs to be validated in each case.

## **I7: Consistency of the NER 5.3.9 Application**

### **Discussion points and key takeaways**

- A lack of consistency in the interpretation and application of relevant NER clauses (i.e. interpretation of the wording within the NER) is a major cause of inconsistency in application.
- Potential solutions to address consistency that were raised include:
  - Resolving concerns with NER wording which will help provide flexibility and help resolve inconsistency; and
  - A NER 5.3.9 Guideline setting out principles for the application of NER 5.3.9, including where other alteration approaches, such as NER S5.2.2 are more appropriate.



- Proponents should ensure high quality of their NER 5.3.9 submissions, by providing NSPs and AEMO with all necessary information (concerning what is changing and what elements of the generator performance is impacted or conversely detailing why performance is not impacted).
- Difficult to have a one size fits all approach for all jurisdictions given the differences between the NER states. For example, in some areas of the NEM, minor changes will cause major stability issues versus stronger grid locations a generator can make minor changes to performance, and it will mean very little impact to the localised network. However, a clear Guideline outlining the NER 5.3.9 principles and how they should be applied, and clearer, more fit for purpose wording in the NER should provide more alignment on the interpretation and intent of the NER.

### **I8: Understanding of various alterations treatments**

#### **Discussion points and key takeaways.**

- The NER should provide for greater flexibility to bring alterations online more efficiently, where those alterations, despite resulting in reduced performance, benefit the network.
- Significant confusion surrounds treatment of legacy plant, even 2–3-year-old plant.
  - Inability to obtain support from the OEM can make the process very difficult.
- Example scenarios previously identified should be further developed to better describe the NER 5.3.9 intent for each, the approach taken, etc.
- Further assessment of these scenarios (outlined in section 2) is required to identify:
  - whether, for a particular scenario, it may be more appropriate to assess as a detailed design change within the R1 process rather than under the NER 5.3.9 process;
  - what level of assessment is necessary, and why;
  - whether proponents could avoid the need to undertake an NER 5.3.9, based on not triggering the criteria of NER 5.3.9(a) clause;
  - whether there are minor changes which match the existing model and require no further assessment and can be deployed; or
  - which, if any alteration scenarios can be validated with on-site testing.
- The example of a system alteration which results in a generator non-compliance and requires generator retuning (e.g. the additional of synchronous condensers to the system) was discussed.
  - Attendees questioned whether this justifies or requires a NER 5.3.9 process and considered that the retuning be validated via generator testing. Or is this process managed via an S5.2.2 process?
- Generators are required to meet GPS all their life, irrespective of changes on the network.

### **I11: Application of AAS requirements per NER 5.3.4A(b1)**

#### **Discussion points and key takeaways.**

- The TWG considered that there should be a requirement to adopt engineering judgment to establish that a generator has maximised its performance. A generator should not be required to meet the new AAS (as discussed previously in relation to the purpose of the NER 5.3.9 process).
  - If this is NPS and AMEO view, then greater guidance on this should be provided.
  - AEMO's view is that, typically, the NER 5.3.9 process should not be used to increase generator performance beyond what the proposed alteration will realise. However, minor exceptions might apply where mutually agreed for minor amendments (e.g. tuning as agreed).



- Issues have been experienced by generators where there is an expectation from NSPs and/or AEMO that:
  - performance should be improved when a generator is altered;
  - the proponent must demonstrate why it can't meet a higher standard, which can become circular; and
  - generator hasn't achieved out the maximum possible performance for the proposed alteration.
- The industry has an expectation that performance should improve, where possible. However, if the generator meets its GPS before an alteration, then why must its performance be increased?
  - Results in proponents avoiding new technology or changes to their plant which provide a benefit to the network
- There is a need to further determine whether increased performance should be documented for use operationally, even if not enforced.
- If increased performance is not enforced, what incentive is there for a generator to provide that increased performance? If performance is increased, there will be a network benefit however does it need to be documented at all?

## Workshop 5 – Explore the Intent of NER 5.3.9

### Straw person intent for discussion:

The overarching intent of the NER 5.3.9 is to provide a change management process to accurately capture performance of the altered plant in the GPS and to ensure there is no adverse impact on the power system because of the alteration.

Where were the areas of alignment?	What were the key ideas for change proposed?
<ul style="list-style-type: none"> <li>• Statement is clear and succinct.</li> <li>• Clearly Identifies NER 5.3.9 as a change management process.</li> <li>• Outcomes focused rather than a black and white reading of NER.</li> </ul>	<ul style="list-style-type: none"> <li>• Is it also to assess impact?</li> <li>• Delete 'and'</li> <li>• Intent should also highlight was the NER 5.3.9 is 'not', i.e. should not discourage new technologies and upgrades</li> <li>• Nothing about financial investment effects or rights</li> <li>• Is the aim to capture the performance of the altered plant in the GPS or to assess its performance against its existing GPS (and then update the GPS if needed). Suggest that if the assessment finds there is no change to the GPS, then the process be closed. If GPS does need to be updated, then that requires a 5.3.10 letter</li> <li>• 'Adverse' requires clarity; clarifying the onus of proof and whether we are happy to accept it - whether it is improved or degraded</li> <li>• Allow the NSP to define alteration process scope before developer initiation.</li> <li>• Highlight that NER 5.3.9 isn't the sole change management process for generators; additional</li> </ul>

clarity on NER S5.2.2 and NER 4.14(p) processes and the intent and application of these clauses is needed.

- So this needs to be about assessing if there is any change in control performance, assessing that impact on the power system and if so, capturing this in the GPS AND models as required (update GPS and models where necessary)

### Straw person principles for discussion

1. A generating system should not be required to revisit GPS to achieve performance above what is reasonably achievable by the alteration.
2. A NSP and AEMO may request performance above what is proposed by the proponent to be achieved by the alteration where:
  - AEMO and/or the NSP can demonstrate there is a system requirement for the increased performance; or
  - It may be achieved with minimal burden (time/cost e.g.no additional plant) and the generator must consider its ability to meet this request in good faith.
3. A generating system should not be required to capture in the GPS a technical requirement that did not exist when the agreed GPS was established for the clauses that are not affected by the alteration.
4. Where independent assessment of existing and new generating units is possible, any assessment of performance should be on new units (and existing units will not require updated GPS).
5. Any generating unit is required to update or establish its GPS should be accompanied by a suitable generator model.

Where were the areas of alignment?	What were the key ideas for change proposed?
<ul style="list-style-type: none"> <li>• Captures improved performance in the GPS.</li> <li>• Allows NSPs to request reasonable higher performance if needed by the power system.</li> <li>• Old and new units separated (where possible) from a GPS perspective.</li> <li>• Not including any new performance requirements in assessment against GPS.</li> </ul>	<ul style="list-style-type: none"> <li>• Certain alterations should not require approval.</li> <li>• Clarify when NSPs advise on additional performance requirements, communicated with the 5.3.9 letter.</li> <li>• Should 5.3.9 apply only after R1 or R2? To the extent that CA-&gt;R1 is design refinement as actual equipment information is available, then that is not a change process. That's why we have S-&gt;D-&gt;R1 -&gt; R2 stages.</li> <li>• Acknowledgement that assessment methodology has changed over time, so legacy plant that was considered compliant previously may now be considered non-compliant, although the performance hasn't changed.</li> <li>• Is it practical to separate GPS of legacy plant from GPS of new plant given that they are part of the same generating system e.g. BESS behind connection point? Can a BESS retrofit be called out as a specific scenario?</li> <li>• Issues identified with BESS retrofit were: - need to update old models for the legacy assets - Risk that your legacy GPS would be reopened - issues around</li> </ul>

alignment between the old models and the new PSCAD models of the legacy plant.

- Is there a need to develop models for legacy plant? Depending on the change, model may not always be relevant.
- Caution against capturing all improved performance due to potential trade-offs with other GPS clauses.
- NSP/AEMO should demonstrate the need for improved performance above demonstrated compliance by proponents for existing generating systems.
- Emphasise that improved performance should be optional, not mandatory.
- Consider project impact vs. network benefits.
- Guidance on application of "minimal burden" & "demonstration of network need"

### Performance meeting agreed GPS

6. Generating system alteration will be approved, subject to confirmation that there are no adverse power system impacts resulting from the generator system alteration

Where were the areas of alignment?	What were the key ideas for change proposed?
<ul style="list-style-type: none"> <li>• Burden of proof should lie with NSP/AEMO to demonstrate no adverse impact on the power system and their standards compliance.</li> <li>• No objection to this one.</li> </ul>	<ul style="list-style-type: none"> <li>• Interpretation of "network impact" varies among stakeholders (NSPs, AEMO, personnel) - guidance required.</li> <li>• Consider a principle that AEMO / NSP must undertake the minimal compliance assessment required to demonstrate impact of the technical change</li> <li>• Provision needed for "like for like" replacements; question if NER 5.3.9 process applies.</li> <li>• Replacement of hardware (e.g. transformer) should not inherently demand approval.</li> <li>• Assessing the impact to the GPS can be a huge can of worms, as this could be the size of a whole GPS connection process. Need a Principal that AEMO / NSP must undertake the minimal compliance assessment required to demonstrate impact of the technical change. For instance, if a protection change is being done, proponent shouldn't have to run all modelling studies for instance. Or if a change to active power control is done, they shouldn't have to study faults/voltage control. A like for like replacement of a transformer may only require an FAT result to prove it is the same spec with no modelling at all.</li> </ul>

## Performance above agreed GPS

7. Generating system alteration will be approved, subject to confirmation that there are no adverse power system impacts resulting from the generator system alteration.
8. Improved performance should be captured in an updated GPS so that the power system is operated on accurate and up-to-date performance data that can be relied on by AEMO and NSPs.

Where were the areas of alignment?	What were the key ideas for change proposed?
<ul style="list-style-type: none"> <li>• Ensures the inclusion of enhanced performance in the GPS</li> <li>• NSP may request reasonable higher performance if power system requires.</li> <li>• Clearly worded and understood.</li> </ul>	<ul style="list-style-type: none"> <li>• Alterations should not require standalone approval.</li> <li>• Timing of NSP's advice on additional performance requirements, preferably communicated during the 5.3.9 letter submission rather than the process itself.</li> <li>• NSP/AEMO onus to demonstrate performance beyond proponent demonstration, especially for existing generating systems.</li> <li>• More clarity needed on capturing increased performance and its interaction with general principles and possible adverse impact on other clauses; and on when increased performance should be captured.</li> <li>• 'no adverse impact' needs to be defined.</li> <li>• Some of the improved performance that could be potentially unlocked could come at a cost of another GPS clauses that would have not otherwise been impacted (e.g. if the OEM can make upgrades to reduce the communications delay of the system, which in turn theoretically unlocks faster response times, this should not be a mandated change as a result. The faster comms will generally improve the performance of the existing settings).</li> </ul>

## Performance below agreed GPS

9. Approval of performance below agreed GPS will be based on engineering judgement by AEMO and the NSP, where the alteration does not result in a nett adverse power system impact.

Where were the areas of alignment?	What were the key ideas for change proposed?
<ul style="list-style-type: none"> <li>• Recognition that flexibility is needed, such as in the case of decommissioning inverters to ensure continued plant operation.</li> <li>• Acknowledgment that deviations from GPS might not be straightforward, especially considering changes to specific parameters like curves, fault current contributions, or injection thresholds.</li> </ul>	<ul style="list-style-type: none"> <li>• Revisions are needed to remove the limitations present in rule 5.3.4Ab(1A) regarding the new Minimum Access Standard (MAS).</li> <li>• Transparency in the use of "engineering judgment". Higher performance doesn't always translate to improved system security outcomes.</li> <li>• Principle should have regard to the MAS as a 'floor' for performance.</li> </ul>

- Agreement that performance reduction can be permitted if there's no adverse system impact.
- Reduction in performance should be allowed provided that no adverse impact.
- "Engineering Judgement" is too broad as it doesn't convey the objective or principal for the judgement. Principal could be: "that any reduction should be accepted where the cost or effort (including opportunity cost for the connection of other projects) to achieve the same GPS requirement exceeds the benefit the resolution will provide to the power system, in terms of increased hosting capacity and hence consumer energy cost".
- "Nett adverse impact" very vague, what does this mean?
- Acknowledge need for flexibility, however concerned about overall degradation of performance.
- Big issue is moving from grid following to grid forming capability. Can this be explicitly called out?

## Workshop 6 – Explore Solutions for NER 5.3.9 Reform

### 03: Network Impact Materiality Thresholds + 04: No material impact Objective Studies

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• Objective studies seemed like they would be very difficult to define.</li> <li>• Based on feedback, AEMO guidance seemed appropriate here, rather than an NER Guideline.</li> </ul> <p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Defining materiality and 'adverse impact' would not be straight forward and should not be defined too closely to allow engineering judgement.</li> <li>• Will depend on the specifics of the alteration.</li> <li>• Principles should be outlined rather than specific studies, but examples with associated studies should be provided. It would be a difficult (impossible?) task covering every possible scenario.</li> <li>• There should be pre-determined list of issues determined as material and non-material. <ul style="list-style-type: none"> <li>• AEMO best placed to write the guideline.</li> </ul> </li> </ul>	<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• Training will be important for AEMO, NSPs and their contractors to ensure buy-in</li> <li>• AEMO guidance should be principles based and focussed on the philosophy of appropriately applying engineering judgement, rather than being too prescriptive.</li> </ul> <p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Adverse impact should be built around cost of rectification vs impact to hosting capacity. It should be purely around LCOE and system security. This materiality needs to be a commercially driven materiality assessment, with an engineering analysis feeding into that.</li> <li>• Could also be implemented as training for AEMO/TNSP and their subcontractors, and an independent technical review of their decisions.</li> <li>• Guidance should be around philosophy to apply for engineering judgement, along with some "worked examples".</li> <li>• This CRI group should feed in the material items to AEMO guide. It will reduce the extent of consultation.</li> </ul>

## 09: Clarity on applying NER 5.3.9 or s5.2.2 or 4.14(p) for an alteration

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• AEMO guidance is appropriate</li> <li>• Guidance along with generalised references on what has been agreed on previously to ensure that flexibility and precedence are captured.</li> <li>• It is crucial that any mechanism applying to NSP/AEMO-requested alterations be: <ul style="list-style-type: none"> <li>○ i) non-coercive; and</li> <li>○ ii) a collaborative process between NSP/AEMO/Owner/OEM to find the most efficient solution to the identified problem</li> </ul> </li> <li>• Robust, all-encompassing principles supported by examples will lead to less confusion.</li> <li>• Rule is clear on intention of each process, but industry interpret Rule requirement for their advantage.</li> <li>• Any setting change requested by the NSP can also follow the S5.2.2 process.</li> <li>• Any setting change to resolve a noncompliance can follow the S5.2.2.</li> <li>• 4.14(p) only acknowledges GPS can be changed with all 3 parties' agreement. It should be coupled with another process like 5.3.9 or S5.2.2. Use of 4.14(p) to bypass the 5.3.9 or S5.2.2 is not appropriate.</li> </ul>	<p>Clutch takeaway</p> <ul style="list-style-type: none"> <li>• Based on feedback, AEMO guidance seemed appropriate here, rather than an NER Guideline.</li> <li>• Worked examples and NSP, AEMO and subcontractor training will help to ensure consistency.</li> </ul> <p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Very supportive of an AEMO guideline to clarify.</li> <li>• Supportive, however based on agreement between NSPs to apply the guidelines consistently.</li> </ul>

## 10: Treatment post 5.3.4 but pre-R2 + 11: Inability to add 'Headroom' in GPS negotiations

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Need to be able to provide head room, otherwise projects will never be able to get a "firm" 5.3.4a, and that will make investment much harder.</li> <li>• This is appropriate. The R1 process should also include its own methods and processes to modify the GPS, models, etc</li> </ul>	<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• NER change is required. Might need an informal guideline to clarify design refinement from D -&gt; R1 is not a plant change and that should not trigger 5.3.9 (use some engineering judgement).</li> </ul>

- if required (a 5.3.9 equivalent). 5.3.9 should only apply after.
- 5.3.9 is not needed.
  - More appropriate to cover this with R1 rule change.
  - NER amendment is required here. It is the only way. NER change critical, as current NER does not allow a reduction in standards from R0 to R1. And the requirement for AAS in negotiations doesn't allow headroom in negotiations for design flexibility.
  - How to manage the risk of headroom leaking into other customers impacts which will potentially never be used.
  - Purpose of assessment here is to ensure that the developer has delivered on its promises used to achieve the Offer to Connect, and if it hasn't delivered, whether what it is proposing is acceptable. This is an entirely different context to a change post-R2.
  - 5.3.9 is still required post 5.3.4A and preconstruction, as technology changes at faster pace than the connection process, <sup>new</sup> inverter/sizing/FW/Transformers which will necessitate a change.
  - Agree with not requiring 5.3.9 assessment/process when there is a change between 5.3.4A and R1 stage. The R1 process itself is the change management process.
  - Suggest AEMO put forward the suggestion in the AEMO response to AEMC (Australian Energy Market Commission).
  - Not supportive of anything additional to current rule change

## 12: Guidance on treatment to adding a BESS to plant behind existing connection point

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• Guideline will clearly need to deal with scenarios where performance cannot be separated and those where assessment can be combined.</li> <li>• Further work needed to investigate opportunities to better clarify how to separate performance, under which circumstances etc.</li> </ul> <p>Specific Feedback:</p>	<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• There was a lack of alignment on whether a rule change was necessary. Clutch felt this was more about coupling a Guideline with NER amendments to support flexibility, such as amendments to 5.3.4A(b)(1A) and 5.3.4A(b1) which would better support the establishment of hybrid plant.</li> <li>• This would not likely require a separate NER amendment other than those mentioned to address other NER 5.3.9 issues.</li> </ul>



- Some clauses it is not possible to separate the performance and guideline shall acknowledge those and allow for combined assessment.
- Existing generator performance requirement should be untouched in the 5.3.9. New requirements can be applied to the BESS. Combine the performance for existing plant and BESS as necessary.
- A specific scenario that is likely to become more common. Hence, it deserves its dedicated guideline to cover it. Standardised across NSPs and AEMO.
- The process could be facilitated by making it much easier to move the legacy plant's connection point to the MV level, then adding the BESS with a separate connection point at a separate MV level. A solution would have to be found for how they "share" power flows, losses, etc. through the (existing) common transformer and into the network.

Specific Feedback:

- Rule change required to allow grandfathering of legacy assets. Might also need an informal guideline on how to capture performance of different technologies.
- Guideline only. Do not see a justification in amending rules.
- Need for legacy plant models also to be managed but might be under the PSMG instead.
- Not sure guidance will help here, NER very prescriptive here. Rule change anyone? :)

**15: Application of AAS requirements per NER 5.3.4A**

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
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Clutch takeaway:

- Consistent feedback that existing plant (which has been performing sufficiently against its agreed GPS) should not be made to increase performance. Otherwise, this is clearly operating as a barrier to making alterations which might otherwise benefit the system.

Specific Feedback:

- Being clear via principles is key. Engineers who are likely to err on the side of overly academic/risk averse would arguably be less likely to appreciate the capex impacts of outcomes dependent upon their decisions, so it needs to be sufficiently balanced.
- Guidance on this is important to AEMO/TNSPs in context of the project. I.e. increasing CAPEX by 5% is catastrophic to a developer but may not sound like much to a TNSP.

Clutch takeaway:

- Not all participants agreed a rule change is necessary, however Clutch thinks there are participants who will take a strict interpretation of the NER, regardless of applicable guidance, and as such, a rule change seems appropriate.
- Guidance should also be provided to support interpretation of any applicable NER amendment and to support interpretation issues while NER amendment process is underway.

Specific Feedback:

- This is an interpretation issue that can be addressed with a guideline or factsheet
- Need to remove this clause and its applicability to plant alternations that are not affected (i.e. grandfathering).
- Rule change is appropriate to achieve this.

- Unless change to number of units or capacity, existing generator performance should be retained under 5.3.9 process.
- Support NER change. There is a misunderstanding that meeting the AAS will 'fix' the power system. In fact we have learnt that meeting the AAS can have an adverse impact on the power system (e.g. large iq injection, fast rise times etc).
- Unless additional plants are added or capacity increase. Existing performance standards should be the minimum and automatic.
- If the existing benchmark (in the form of existing performance standards) can be met, this should not really become a negotiation.
- If the existing GPS is "adequate" then why should triggering this process push for more capability? This negotiation process should only apply if the GPS cannot be met.

## 17: Grandfathering Assessment Methodology

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Dependence upon previously submitted, reviewed and approved methodologies should be honoured to the extent that they don't cause demonstrable (via modelling or clear reasoning) material system stability/security issues.</li> <li>• Surely commissioned plant can demonstrate actual performance.</li> <li>• New interpretation should not be applied to existing facilities which was assessed under previous interpretation.</li> <li>• The assessment methodology evolves over time, projects were design with the prevailing methodology at the time of connection.</li> <li>• Disagree. NER change also required; else we will be in the same boat that we are in right now.</li> <li>• NER change required to enable this. AEMO's current assessment methodology is based around "GPS</li> </ul>	<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• This will be a site-specific assessment as to the overall impact which a rule might make to ridged.</li> <li>• Guideline will only get so far if NER is prescriptive.</li> <li>• Supportive of an assessment guideline to provide clarity.</li> <li>• NER change required along with a guidance note to consider existing performance in the context of the overall power system performance.</li> <li>• Supportive, however based on agreement between NSPS to apply the guidelines consistently.</li> </ul>

Compliance" which they are obliged under the rules to assess. If they are willing to grandfather certain historical assessment methodologies, then they are either undermining their current assessment methodologies as exceeding the rules, or allowing plants to go through that they determine do not meet the GPS. E.g., if grandfathered plant is allowed to trip for a corner case, but a new plant is determined non-compliant, then AEMO would be in breach of the rules.

## 20: Clarity on legacy plants without models

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• AEMO/NSP should strengthen the clarity around requirements for legacy plant models within the PSMG.</li> <li>• PSMG should include details of the approach NSPs/AEMO can take to support participants to prepare models where required.</li> <li>• Guidance should be paired with AEMO proactively writing to participants informing them of model requirements to ensure they can be prepared for an NER 5.3.9.</li> </ul> <p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• More clarity on how 5.3.9 process can be applicable to legacy plants would be helpful. Should we expect the plant to meet the current min? This is not clear.</li> <li>• There should be process with the NSP who sign off on performance to progress the alternation without models.</li> <li>• Important to have this as a guideline in PSMG, as this level of detail is not in the NER. Accuracy for an operating plant is not as critical (as we already have the operating data)</li> </ul>	<p>Clutch takeaway:</p> <ul style="list-style-type: none"> <li>• Seems to be a level of alignment that the PSMG could be broadened to provide additional guidance here.</li> </ul> <p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Suggest a guideline for developing models for legacy plant using test results, either in PSMG or separate.</li> <li>• AEMO guide and PSMG guide appropriate in legacy plants</li> </ul>

## 21: Guidance on treatment/approach to like for like replacements

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?

Specific Feedback:

- Like-for-like replacement of a passive element of the plant (e.g. transformer, static reactive power device) should not be subject to any review. It is the Owner's risk if the replacement gear causes a non-compliance with its GPS.
- Guidance note sounds good. There isn't often a true 'like for like' replacement unfortunately.
- Plant should not follow 5.3.9 for small replacements like relays. Like for likeness may be resolved during the 5.3.9 process. It is difficult predetermine like for like prior to the process.
- Like for like can be applied for passive elements not for dynamic elements.
- Again, guidance appropriate. A like for like change on a subcomponent should be subject to desktop review - as it's a practical engineering issue to implement, it's not a choice by the Proponent post install. The industry innovates and keeps changing, and the Generator performance has already been demonstrated through R2, so this is really a "replacement" activity (i.e. changing a failed Transformer or installing a newer version of a WTG/BESS that was destroyed)/damaged during operation.

Clutch takeaway:

- Guidance would seem appropriate here and should define what is appropriate to consider as a like for like and what is not.

Specific Feedback:

- A factsheet should be sufficient, detailing for both inverter based and rotating plant. If you can't demonstrate something is like for like you have bigger issues.

**23: Define a mechanism to capture two lots of performance for two technologies behind same connection point**

Is the solution appropriate?

How could it better address the issue?

Is the instrument defined in the straw person appropriate?

Clutch takeaway:

- Clutch's interpretation is the IESS rule change does not deal adequately with assessing and capturing performance for hybrid systems where multiple technologies are connected behind a common connection point.

Specific Feedback:

- This is already considered as part of the Integrating Storage rule change
- Agree with comment above that this is already allowed for by IESS (unless the

Clutch takeaway:

- Clutch's position is this issue is broader than purely a NER 5.3.9 issue and further work is required to establish a framework and associated guidance to deal with such situations.

Specific Feedback:

- Guidance note required on how to assess and capture performance (in addition to NER change).

reach is insufficient?) - AEMO guidance about the approach should be clear.

- IESS and amending rule requires GPS at the connection point so NER change required along with an informal guidance note on how to capture performance.
- Better write two separate clauses for each technology and combine certain clauses appropriately where both can meet combined.
- The GPS allows for this, have the engineering freedom to capture this, so guidance is probably the best way to standardise the approach. Remembering that specifications in a GPS should be verifiable (like any specification) so must be relevant to the BESS/WTG/PV Generator. i.e. having different ambient temp limits for different OEMs of inverter depending on PV/BESS/WTG. This is how it's modelled/tested in practise.

## 26: Treatment/Approach to Transitioning from GFL to GFM.

<p>Is the solution appropriate? How could it better address the issue?</p>	<p>Is the instrument defined in the straw person appropriate?</p>
<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Some performance reduction should be allowed for GFL from GFM as it provides essential inertia, system strength and FFR to the system. Any rigid no degradation of performance can discourage such changes.</li> <li>• 5.3.4A (b)(1A) precludes this happening (including limiting NSPs) so NER change required.</li> <li>• AEMO should develop an ultra-streamlined process to encourage developers to do this - it may even be an entirely different process compared to other 5.3.9 processes. It should almost bypass the usual processes and work involved to encourage this as much as possible.</li> <li>• Key thing to capture here is that Grid forming inverters are replicating synchronous machines, and the NER differentiates between inverter/synchronous machines in the technical rules. Need to bridge that gap, it may be as simple as a rule change to</li> </ul>	<p>Specific Feedback:</p> <ul style="list-style-type: none"> <li>• Support a guideline or white paper that teases out the actual technical issues</li> </ul>

include grid-forming under the "Synchronous Generator" definition.

## 29: How to determine which reductions in performance are appropriate

Is the solution appropriate? How could it better address the issue?	Is the instrument defined in the straw person appropriate?
<p>Specific Feedback:</p> <ul style="list-style-type: none"><li>• Based on materiality some reduction should be allowed. On the other hand, if any improvement can be done it should also be documented in the GPS.</li><li>• It won't be easy to cover all possible scenarios in a guidance documents. The issues could change depending on project-by-project basis. Therefore, including some provision in the NER for AEMO/NSP to use engineering judgment would be good. Allowing AEMO/NSP to accept performances below previously agreed performance, only when required through minor changes to 5.3.4A (1A).</li><li>• GPS changes should be assessed in a similar way to new GPS. Performance reduction may not be as clear as people think. For example, going from GFL with 4% Iq injection to GFM with lower Iq injection (since they have different ways to respond to faults) should not be considered a performance reduction if it is positive to system stability.</li><li>• This is tied to the above point (GFL-&gt;GFM). Rules need to be changed to allow this (5.3.4A(b)(1A). Lower plant performance can have overall system benefits.</li><li>• Guidance document should be Principles with worked examples, rather than rigid rules.</li></ul>	<p>Specific Feedback:</p> <ul style="list-style-type: none"><li>• Requires 5.3.4A(b)(1A) to be removed, otherwise existing performance standard is set as minimum.</li><li>• Support a guideline or white paper that teases out the actual technical issues</li><li>• Need to challenge ourselves on whether a grid-forming inverter has actually "degraded performance" if it's replicating a synchronous generator. Most synchronous generators don't meet the MAS for inverter-based technologies under the NER. 5.2.5.13 for example.</li></ul>

## Appendix 2 - Key issues captured and explored during workshops

Issue ID	Issue
01	I7 - A lack of consistency in NER 5.3.9 application - There are dramatic differences between 'good and bad experiences' under the same NER 5.3.9 rules, attitudes of the individuals/NSPs as well as other parties.
02	Ensure Investment is incentivised
03	Assessment of network impact and how to clearly define and demonstrate whether an alteration results in an 'adverse system impact'. How to clearly define materiality thresholds for what is "adverse impact on network" and where the NSPs and AEMO can push for higher performance.
04	Clarify whether objective studies can show an alteration has no material impact on power system
05	No clear process for NSP or AEMO initiated alterations.
06	Treatment/ approach to ensuring a broad understanding of how to deploy engineering resources most efficiently and effectively.
07	A lack of clarity regarding what the NER 5.3.9 process is not meant for.
08	I8 - Understanding of various alterations treatments - A lack of clarity around the level of assessment required prior to determining the scope of an individual generator alteration (especially for alterations considered minor or cases considered by proponents as 'like for like' replacements).
09	Clarity around when to apply NER 5.3.9 or S5.2.2. or 4.14(p) for a given alteration.
10	Treatment/ approach to alterations post NER 5.3.4 but pre R2/registration.
11	Inability to add "headroom" in GPS negotiations means any small change in design could result in non-compliance.
12	Guidance on treatment/ approach to adding a BESS to plant behind an existing connection point.
13	Need a way to triage. Is the alteration something they needs to be assessed? E.g. control logic change that impacts voltage control performance? Or is it a bug fix or something else?
14	Ensure proponents are well prepared and educated before commencing an NER 5.3.9.
15	I11 - Application of AAS requirements per NER 5.3.4A(b1). There is a lack of clarity, considering NER 5.3.4A(b1), as to whether a generator alteration triggers a requirement to increase performance to meet the Automatic Access Standards (AAS) under the current NER version when the generator is altered.
16	Define how to encourage NSPs and AEMO to agree with developer on the scope of assessment.
17	Grandfathering assessment methodology. New interpretations of existing standards.



18	I5 - Acceptance of performance where current NER requirements didn't exist. A lack of clarity on the applicability of the current MAS to plant for which that standard did not exist at the time the plant's original GPS was registered.
19	Define what elements of a generator model should be updated to capture a given generator alteration.
20	Clarity on legacy plants without models.
21	Guidance on treatment/ approach to 'like for like' replacements
22	How to balance time/cost impact vs network impact reduction benefits?
23	Define a mechanism to capture two lots of performance for two technologies behind the same connection point.
24	For legacy projects behind the same connection point should agree on principles on performance requirements, assessment principles and definitions of performance.
25	Guidance on the case where new capacity is added to an existing plant and the plant is being registered under a single GPS.
26	Treatment/ approach to transitioning from GFL to GFM.
27	Clarify when performance should be increased
28	I4 - Acceptance of performance below GPS where above current NER requirements. Lack of flexibility (when considering NER 5.3.4A(b)(1A)) to agree differing performance from original GPS - can or should a reduction in performance (relative to current agreed GPS) be directly related to, or offset against, a gain/improvement elsewhere, or be allowed if desirable given local system conditions (i.e. weak vs strong grid); There is a strong case to consider trade-offs.
29	How to determine which reductions in performance are appropriate.
30	How to make it clear as to why a reduction in performance is problematic?
31	Guidance regarding 'engineering judgement' to ensure consistency on what is or isn't an issue when performance is altered. How to provide support to NSPs and AEMO to apply reasonable judgement as to which alterations will have a material impact on performance.

# Appendix 3 - How proposed recommendations will address issues

Clutch proposes the recommendations will address the key issues identified earlier in the following ways.

Key workshop finding	How recommendations will address findings
<p>1. Proponents, NSPs and AEMO each have inconsistent views on when, where and how NER 5.3.9 is applied.</p>	<p><b>Recommendation #2 - AEMO Generator Alteration Framework will:</b></p> <ul style="list-style-type: none"> <li>• Clarify the intent of the NER 5.3.9 clause as it pertains to different alteration scenarios</li> <li>• Support alignment of proponent, NSP and AEMO on scenario and associated process at the start of the alteration process</li> <li>• Ensure clear and transparent mechanisms for particular alteration scenarios to follow defined processes</li> <li>• Better define the intent of the NER 5.3.9 process</li> </ul> <p><b>Recommendation #3 - NER amendments will:</b></p> <ul style="list-style-type: none"> <li>• help to ensure consistency by removing clauses which have caused confusion.</li> </ul>
<p>2. There is a lack of information to support Proponents to understand and correctly apply NER 5.3.9 to their operations.</p>	<p><b>Recommendation #2 - AEMO Generator Alteration Framework will:</b></p> <ul style="list-style-type: none"> <li>• Provide a mechanism to help generators self-diagnose and triage their alteration, and the associated process which will help to ensure they are better prepared and accountable for the process.</li> <li>• Guideline and checklists will provide support to apply the correct alteration scenario and process to the specific alteration.</li> <li>• Clarify when to apply NER 5.3.9 or S5.2.2. or 4.14(p) for a given alteration scenario.</li> <li>• Provide better guidance around inclusions of BESS or hybrid plants behind a connection point.</li> <li>• Provide the tools to help all stakeholders be better educated and provide greater clarity prior to commencing an alteration process.</li> <li>• Forums and training courses proposed as part of the framework will provide a mechanism to support regular proponent and stakeholder education.</li> </ul>
<p>3. There are limitations under the current NER drafting, creating inflexibility and uncertainty in NER 5.3.9 process application</p>	<p><b>Recommendation #3 - NER amendments will:</b></p> <ul style="list-style-type: none"> <li>• Remove requirement for a NAS to be as close as possible to the AAS per NER 5.3.4A(b1)</li> <li>• Remove requirement in NER 5.3.4A(b)(1A) which prohibits any reduction in a performance standard.</li> </ul>
<p>4. There are concerns over making alterations to legacy plant for fear of reopening GPS or having to create detailed facility models</p>	<p><b>Recommendation #2 - AEMO generator alteration framework will:</b></p> <ul style="list-style-type: none"> <li>• Clarify the applicability of MAS for standards which did not exist when performance standards were agreed.</li> </ul>

Key workshop finding	How recommendations will address findings
(where these did not exist for legacy plant).	<ul style="list-style-type: none"> <li>• Give effect to the intent of the NER 5.3.9 by clarifying performance standards not impacted by an alteration do not need to be renegotiated.</li> </ul> <p><b>Recommendation #5 - Support for legacy plant</b></p> <ul style="list-style-type: none"> <li>• Provide guidance on modelling requirements and support available to provide better clarity on requirements for plant without suitable models when making alterations.</li> </ul>
<p>5. There is uncertainty over roles and responsibilities within the NER 5.3.9 framework</p>	<p><b>Recommendation #2 - AEMO generator alteration framework will:</b></p> <ul style="list-style-type: none"> <li>• Define mechanism for agreeing scope upfront, which will support NSPs and AEMO not to 'over-reach'</li> <li>• Provide better guidance to NSPs and AEMO on: <ul style="list-style-type: none"> <li>○ assessing whether an alteration has a material adverse impact on the system</li> <li>○ appropriately deploying engineering judgement, taking account of impact to the system, cost to proponents and the principles within the NEO</li> <li>○ ensuring consideration is given to how best to deploy engineering resources and ensure resources are not tied up unnecessarily in alteration processes.</li> </ul> </li> </ul>

# Appendix 4 - Generator Alteration Framework phase 2 high level project plan

Phase 2 of the recommended Generator Alteration Framework aims to build on phase 1 by creating an AEMO guideline to include additional areas which need to be further fleshed out and developed before they can be incorporated into the AEMO guideline.

The guideline should be developed in a manner which allows proponents of the alteration to ‘self-diagnose’ their alteration scenario and the likely requirements of the process they are planning to go through as much as possible. This will allow them to plan appropriate resources, timeframes, and budgets for all involved including the NSP and AEMO. This will limit the likelihood and impact of the risk of parties not having adequately planned and prepared for the alteration process.

Phase 2 Project Plan	
<b>Objectives</b>	
<p>The objective of this phase is to create and publish an initial guideline document which will build on the FAQ prepared in phase 1. This guideline will provide greater clarity and certainty to proponents regarding the appropriate process for a given alteration scenario.</p> <p>This phase also aims to give greater comfort to proponents who are specifically worried by the NER 5.3.9 process and what this might mean for their project. This phase will help proponents to appreciate their specific alteration may not fall under NER 5.3.9.</p> <p>This phase aims to identify the top 15-20 potential alteration scenarios and detail the process steps appropriate to each scenario. In doing this it will allow the proponent of the change to determine the likely process it and the NSP and AEMO will need to follow and to ensure alignment with all stakeholders.</p> <p>Clutch notes here it expects there will always be some level of ambiguity and some alterations may not 100% fit into the proposed scenarios and processes. It is recommended after reading the guideline and commencing planning for an alteration, all proponents engage with AEMO and the NSP to discuss and confirm the process as soon as practical.</p> <p>The guideline should be explicitly clear in the expectation that proponents will meet with the NSP and AEMO at a kick-off to align on the outcomes of the proponent’s self-diagnosis, to agree the appropriate scope of assessment under the appropriate alteration process.</p>	
<b>Roles and Responsibilities</b>	
Stakeholder	Responsibilities
AEMO	<p>Take the lead in drafting the key alteration scenarios and alterations processes.</p> <p>Collate information on previous alteration scenarios to inform scenario development throughout this phase</p> <p>coordinate reviews by other stakeholders and incorporate feedback into refining scenarios and processes.</p> <p>Incorporate final scenarios and processes list into updated AEMO guideline for use by participants.</p>
Selected NSP members	<p>Collaborate with AEMO on the key alteration scenarios and alterations processes.</p> <p>Agree on final list of scenarios and processes.</p>
Selected TWG members	<p>Collaborate with AEMO on the key alteration scenarios and alterations processes.</p>
<b>Timeframes</b>	

<b>Start</b>		<b>Finish</b>	
January 2024		May 2024	
<b>Inputs/Outputs</b>			
<b>Inputs</b>			
<ol style="list-style-type: none"> <li>1. AEMO Fact sheet and FAQ – as prepared in phase 1</li> <li>2. Known scenarios of previous alterations undertaken on the NEM, and the approach to assess these</li> </ol>			
<b>Outputs</b>			
<ol style="list-style-type: none"> <li>1. Alteration self-diagnosis checklist and decision tree.</li> <li>2. AEMO guideline v1.0 – published by AEMO - building on FAQ output from phase 1 and incorporating additional guideline content as outlined in this phase.</li> </ol>			
<b>Risks and Opportunities</b>			
<b>Risks</b>		<b>Mitigation</b>	
Not all scenarios are captured in guideline		Continuous improvement phase will allow for ongoing incorporation of additional scenarios as they emerge.	
NSPs cannot agree on a national/NEM wide approach on defining alteration scenarios and processes		Pursue a national approach where possible, however state based sub-sets of scenario/process combinations to be developed where a national approach is not possible.	
Timelines are impacted by NSP/TWG reviewer availability		Incorporate regular, pre-planned sessions with key reviewers to ensure the review process is planned out and they are brought on the journey.	
Guideline development is inadequately planned and resources		There is an unprecedented amount of change in the NEM now, so it is recommended above average amount of effort / resource is dedicated to the implementation of the guideline.	
<b>Opportunities</b>			
Explore a NEM wide approach to align on alteration scenarios and associated processes.			
Create a communications plan to notify industry participants of the developments throughout this phase, which can then be leveraged through subsequent phases. This will demonstrate intent and progress to interested industry stakeholders.			
<b>Tasks to be undertaken</b>			
<b>Task #</b>	<b>Task Description</b>		
1	Identify and define the key common (or potential) generator alteration scenarios which are likely to be progressed by registered participants. This list might include: <ul style="list-style-type: none"> <li>• Areas which might impact system impedance, including: <ul style="list-style-type: none"> <li>○ Transformer replacement;</li> <li>○ Primary plant replacement, such as circuit breakers;</li> <li>○ Changes to cable lengths;</li> </ul> </li> </ul>		

- Areas which might impact the dynamic performance of the generating system, including:
  - Changing inverters;
  - Adding or changing a filter;
  - Adding or changing a capacitor bank;
  - Adjusting inverter capability from grid following to grid forming;
- Firmware upgrades, including:
  - Where intended as a minor change, bug fix etc;
  - where intended to modify performance of the generator;
- Adding new generation, including:
  - Adding capacity and/or increasing the rated output of a generator;
  - Inclusion of a BESS, or a hybrid system behind the same connection point;
- Replacement of a control system or a control system alteration;
- Modification to the PPC to include FFR;
- Any others

2 Agree the above scenarios with AEMO, select NSP representatives and members of the TWG.

3 Define the characteristics of each scenario.

These may include:

- Whether the alteration is intended to modify the performance of the generator;
- facility model requirements;
- whether the scenario is influenced by being in a strong vs weak area of grid;
- whether the scenario is a replacement of existing equipment;
- what technology(ies) are included;
- whether there likely to be an impact on the performance of existing plant, and which performance characteristics are likely impacted;
- connection point, number of connection points, new vs existing connection point;
- what alterations are expected to have a system strength impact;
- what might push generator into a new NER 5.3.4 process;
- which scenarios are likely to result in reduced performance, and why;
- what alterations might not trigger any process and why;
- others?

4 Determine the key questions (in order) which a proponent should ask themselves to determine whether their alteration is a particular scenario (checklist).

Questions might include:

- What is being altered (could be more than one element);

- What is the intention of the alteration (could be more than one intention)?
  - To add new generation capacity;
  - To add new capability;
  - To increase/improve performance;
  - To replace a damaged piece of equipment;
  - To make a routine update to a newer version of firmware;
  - Others as determined through this exercise.

In addition to specific questions to help in self diagnosing the most appropriate generation scenario, questions should include:

- whether the facility has a compliant facility model (in accordance with the PSMG) and if not, directing them to discuss situation with NSP/AEMO.
- whether the facility have any current non-compliances.

These questions will allow the proponent to deal with such issues before they attempt an alteration. This will ensure non-compliances for example, do not impact on the alteration process.

5	Agree the key questions with AEMO, select NSP representatives and members of the TWG.
6	Create a decision tree and checklist to assist proponents in 'self-diagnosis' of which scenario applies for a given alteration, based on the identified scenarios and their associated characteristics.
7	Agree decision tree and checklist with AEMO, select NSP representatives and members of the TWG.
8	<p>Determine the key processes (high level inputs &amp; outputs / process / scope and requirements / clauses impacted / indicative time frames) which should apply for the list of scenarios, These might include:</p> <ul style="list-style-type: none"> <li>• a process where alterations would require a new 5.3.4 connection or do not trigger an alteration process at all;</li> <li>• a process for those scenarios which can be managed under S5.2.2;</li> <li>• a process for those scenarios which can be managed under 4.1.4(p);</li> <li>• alterations which trigger NER 5.3.9, but which only need limited exchange of technical information to validate;</li> <li>• alterations which trigger NER 5.3.9 with a limited set of agreed studies;</li> <li>• alterations to a generating system which are likely to drive a full GPS assessment under NER 5.3.9 (ensuring alignment with the intent of the NER 5.3.9 and noting the intent is not the expose clauses which are not impacted to new performance requirements);</li> <li>• others?</li> </ul>
9	Agree these processes with AEMO, select NSP representatives and members of the TWG and aim for a national approach where possible.
10	<p>Map out each alteration process, including:</p> <ul style="list-style-type: none"> <li>• The objective of the alteration process;</li> <li>• high level inputs &amp; outputs, including what is to be provided by the proponent, including required detail within a technical note</li> <li>• indicative process</li> </ul>



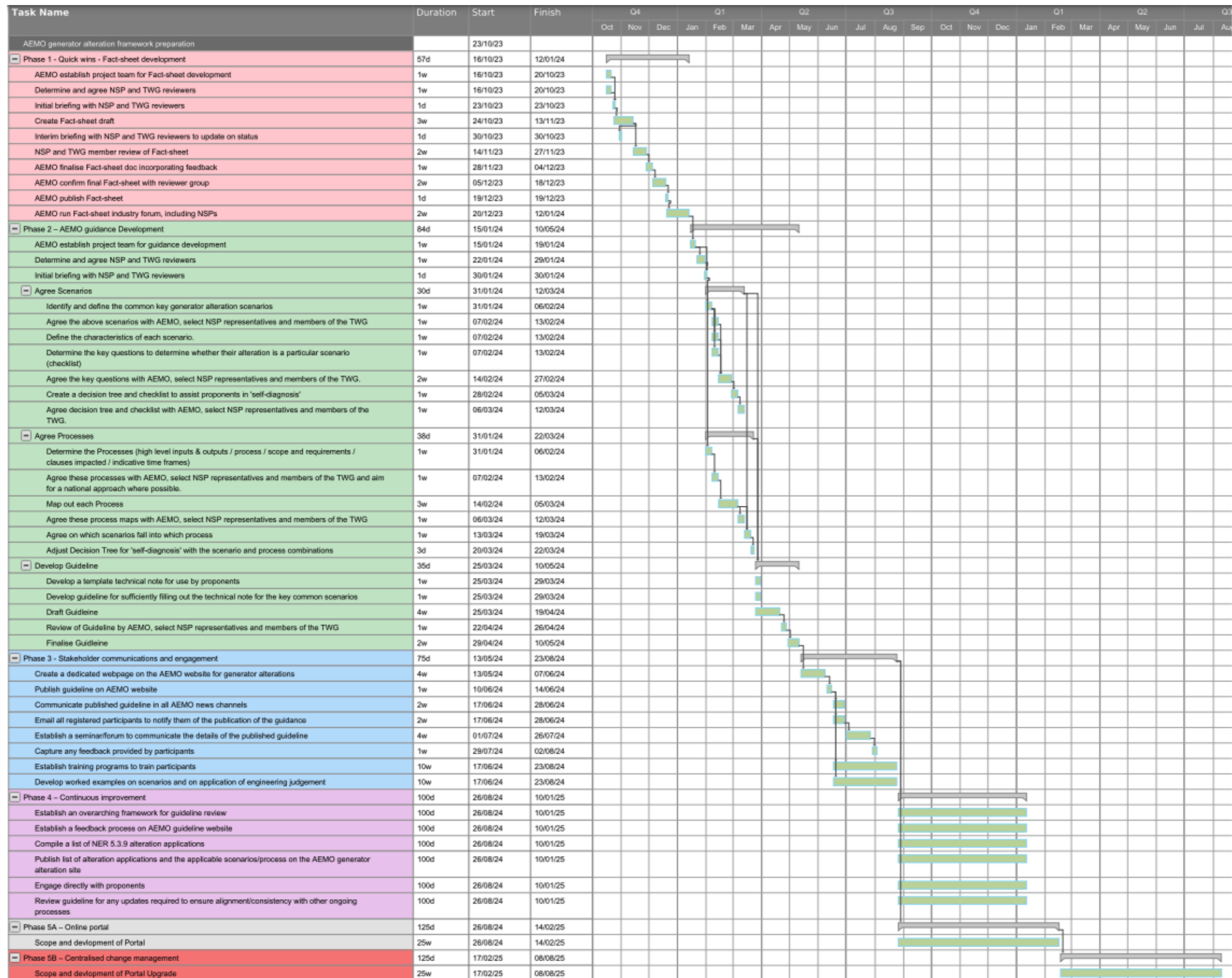
- indicative scope
- indicative timeframes
- roles & responsibilities
- potential risks etc for each process.

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11	Agree these process maps with AEMO, select NSP representatives and members of the TWG.
12	Agree on which scenarios fall into which process.
13	Adjust Decision Tree for 'self-diagnosis' with new scenario and process combinations, as they are identified.
14	Develop a template technical note for use by proponents to facilitate a robust demonstration of the impacts of their alteration and clarifying the expectation they are demonstrating such impacts.
15	<p>Develop overarching AEMO guideline which should incorporate:</p> <ul style="list-style-type: none"> <li>• FAQ detail developed in phase 1;</li> <li>• detail of the scenarios and processes (outlined above) to help proponents in understanding the appropriate process for their given alteration scenario;</li> <li>• support in using the checklist and decision tree tools to self-diagnose the scenario and process of a given alteration;</li> <li>• detail on the amount of information needed for each alteration scenario;</li> <li>• detail the expected model requirements for each scenario;</li> <li>• support for sufficiently filling out the technical note for the key common scenarios including providing clarity around how technical notes should be completed to demonstrate that performance is not affected by a proposed plant alteration i.e. the alteration falls into a process other than NER 5.3.9, which is therefore not triggered.</li> </ul>
16	<p>Define a facilitated review mechanism (independent engineering expert) to manage disagreements or misalignments in the requirements under a specific alteration application. This may leverage similar existing processes within the NER such as that laid out in NER 5.4.</p> <p>Findings from the independent expert should link back to the continuous improvement loop (in phase 4) to help improve on the scenarios and processes used in self-diagnosis. This information may highlight specific NSPs who are having specific issues with alteration processes over time and need additional support from this resource</p>

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# Appendix 6 - AEMO Generator Alteration Framework Schedule



# Appendix 7 - Notes on revised NER 5.3.9 Intent and Principles

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## Notes on NER 5.3.9 Intent statement

This intent statement was modified from the original presented during workshop 5 based on TWG feedback during that workshop. Alterations from original intent statement include:

- Added 'incentivise investment' to make it clear a key purpose is to ensure greater certainty of investment and not to be a barrier to investment in new generation capacity and improved technologies.
- Made it clear this process is for proponent driven alterations, i.e. where the proponent is seeking to make a change, for whatever reason. AEMO and NSP driven alterations should be managed outside of the NER 5.3.9 process.
- Added a step about assessing the impact of the alteration, to clarify there is also a requirement to assess the impact of the alteration on the plant performance, regardless of the change.
- clarification the intent is not just to capture changes in the GPS, but also in the models and associated data (as applicable).
- Changed 'adverse impact' to 'overall degradation' to clarify that this is about ensuring there is no degradation to the system over time with reduced performance.

## Notes on general principles underpinning the NER 5.3.9 intent

General NER 5.3.9 intent principles were modified from the original presented during workshop 5 based on TWG feedback. Modifications include:

- Deleted the original principle relating to the Principle 2 as this was a major concern for proponents and is akin to the merry-go-round where proponents feel pushed into a loop to try to demonstrate the can or cannot achieve increased performance. NER 5.3.9 should not be the trigger for increasing performance. There is still the protection that alterations can't impact adversely on the system and as such, Clutch considers there is adequate protections to ensure alterations do not impact the system negatively.
- Updated principle 3 to allow provision for capturing performance where a clause which didn't exist is impact by the alteration, based on the capability and studies inherent within the proposed alteration.
- Principle 4 – Clutch included the statement regarding 'where a model is necessary' to clarify there may be alteration scenarios where a model is not necessary to assess the impact of an alteration.

## Notes on principles relating to altered performance

The principles relating to altered performance underpinning the NER 5.3.9 intent statement were modified from the original presented during workshop 5 based on TWG feedback. Modifications include:

- removed reference to the alteration being 'approved', as it is not the alteration which is approved as such. Clutch aligned terminology with clause NER 5.3.10 around the acceptance of performance standards.
- Clutch also aligned terminology with general principles re 'overall degradation to the power system'.

# Appendix 8 - CRI 9 Guiding Questions: NER 5.3.9 Process Review

The Connections Reform Initiative (CRI) developed nine sets of guiding questions for the process review, addressing issues raised in the CRI, to be collaboratively resolved through co-design workshops and meetings.

Issue	Questions for collaborative discussion
1. Alternative NER alteration mechanisms	<ul style="list-style-type: none"> <li>• Should alternative NER provisions (4.14(p), S5.2.2, 5.6.2) for proposed changes be used more often, noting that it is on the proponent to submit the request and indicate the recommended rule to apply?</li> <li>• Is NER 5.3.9 being overused and could other NER provisions cater to proposed alterations to generating unit equipment, performance, or control settings should be used instead?</li> <li>• Are alternative NER alteration provisions a better option, and in which circumstances?</li> </ul>
2. Advance agreement to scope of 5.3.9 review	<ul style="list-style-type: none"> <li>• Can the developer, AEMO, and the NSP agree on the scope of a 5.3.9 review before the developer proceeds with the change they are considering?</li> <li>• Can the developer use that to inform go/no go decisions relating to a change?</li> </ul>
3. Avoidance of full GPS assessment	<ul style="list-style-type: none"> <li>• Can AEMO and NSPs avoid a full assessment of the GPS during the 5.3.9 process (noting NER 5.3.4A(b)(1) requires that the negotiated access standard is no less onerous than the corresponding minimum access standard)? If so, how should all parties agree on what GPS rules are considered to accurately reflect the changes to the individual project (including any dependent rules)? Or Should the first step be for the developer to clearly state the proposed change, the impacted rules and the nature of the impact, and the rules applicable?</li> <li>• Is materiality a consideration in the above?</li> </ul>
4. Timeframes for review	<ul style="list-style-type: none"> <li>• Should a 5.3.9 review be limited to specific timeframes?</li> <li>• Could the 5.3.4A process timeframes apply to 5.3.9 reviews?</li> <li>• NER 5.3.4A(d) requires AEMO to advise the connecting NSP within 20 business days whether AEMO accepts or rejects the proposed access standard</li> </ul>
5. Determination of new performance standards	<ul style="list-style-type: none"> <li>• Should any changes to performance standards be no lower than the original agreed GPS?</li> <li>• Should any changes to performance standards be no more onerous than the original agreed GPS?</li> <li>• Where the GPS is still met or exceeded after a change of Generator System, and system strength has not been negatively affected, should the Developer be able to proceed under their existing GPS including the version of the NER and the system parameters they used for their 5.3.4A application?               <ul style="list-style-type: none"> <li>○ Note that under 5.3.4A(1A) any proposed amendments to performance standards resulting from an alteration under 5.3.9 should be no less onerous than the existing performance standards.</li> </ul> </li> </ul>

Issue	Questions for collaborative discussion
6. Differential treatments	<ul style="list-style-type: none"> <li>• Should a different approach be considered if a project is in the connection process (i.e. during registration) compared to if it is already connected and generating in the NEM?</li> <li>• Should there be a different approach for the older plant in the NEM (e.g. whose GPS was agreed upon 10+ years ago) that are now considering equipment upgrades, such as changes in equipment or installation of BESS?</li> <li>• Should differentiation between the nature of change being proposed during the 5.3.9 process be considered?               <ul style="list-style-type: none"> <li>e.g. firmware upgrades versus hardware changeouts versus physics of the plant, etc.                   <ul style="list-style-type: none"> <li>○ Could common project Generator System changes such as the addition of Harmonic Filters and adjusted cable lengths be dealt with separately?</li> </ul> </li> </ul> </li> </ul>
7. Review in absence of PSCAD / PSSE models	<ul style="list-style-type: none"> <li>○ How would alteration requests be processed if a plant does not have a working PSCAD and PSSE model?</li> </ul>
8. Treatment of 5.3.4A letter-identified performance issue	<ul style="list-style-type: none"> <li>○ If a 5.3.4A letter includes a requirement to fix a performance issue (for example with a firmware update), should the resolution of that issue then not trigger a Rule 5.3.9 process?</li> </ul>
9. Grandfathering of performance standards	<ul style="list-style-type: none"> <li>• Can the agreed level of performance be grandfathered so that the 5.3.9 process is not exposing the developer/investor/generator to the risk of changed performance expectations?               <ul style="list-style-type: none"> <li>○ Should there be a grandfathering of rules that applied and system that existed when the project's GPS was originally agreed?</li> </ul> </li> </ul>



Clutch Consulting Pty Ltd (as Trustee for the Clutch Consulting Unit Trust)

trading as Clutch Strategic Pty Ltd

ABN 63 144 972 185

Suite 806, 147 Pirie Street, ADELAIDE SA 5000