Department of
Energy and Economic Diversification

GOVERNMENT OF WESTERN AUSTRALIA

Energy Policy WA

Meeting Agenda

Meeting Title:	Evolution of Pilbara Network Rules Working Group
Workstream	Workstream 2 (HTR Workstream)
Date:	9 October 2025
Time:	10:30am – 12:30pm
Location:	Online, via TEAMS

Item	Item	Responsibility	Type	Duration
1	Welcome and Agenda • Conflicts of interest • Competition Law	Chair	Noting	1 min
2	Meeting Apologies and Attendance	Chair	Noting	2 min
3	Minutes of Meeting 2025_09_10 (published 3 October 2025)	Chair	Noting	2 min
4	HTR Implementation: Discussion on issues in workbook.	Chair / Issue Leads	Discussion	1h 50 min
5	Next steps	Chair	Noting	5 min
	Next meeting: TBA			

Competition and Consumer Law Obligations

Members of the PAC's Evolution of the Pilbara Network Rules Working Group (**Members**) note their obligations under the *Competition and Consumer Act 2010* (**CCA**).

If a Member has a concern regarding the competition law implications of any issue being discussed at any meeting, please bring the matter to the immediate attention of the Chairperson.

Part IV of the CCA (titled "Restrictive Trade Practices") contains several prohibitions (rules) targeting anti-competitive conduct. These include:

(a) **cartel conduct**: cartel conduct is an arrangement or understanding between competitors to fix prices; restrict the supply or acquisition of goods or services by parties to the arrangement; allocate customers or territories; and or rig bids.

(b) **concerted practices**: a concerted practice can be conceived of as involving cooperation between competitors which has the purpose, effect or likely effect of substantially lessening competition, in particular, sharing Competitively Sensitive Information with competitors such as future pricing intentions and this end:

- a concerted practice, according to the ACCC, involves a lower threshold between parties than a contract arrangement or understanding; and accordingly; and
- a forum like the EPNRWG is capable being a place where such cooperation could occur.

(c) **anti-competitive contracts, arrangements understandings**: any contract, arrangement or understanding which has the purpose, effect or likely effect of substantially lessening competition.

(d) **anti-competitive conduct (market power)**: any conduct by a company with market power which has the purpose, effect or likely effect of substantially lessening competition.

(e) **collective boycotts**: where a group of competitors agree not to acquire goods or services from, or not to supply goods or services to, a business with whom the group is negotiating, unless the business accepts the terms and conditions offered by the group.

A contravention of the CCA could result in a significant fine (up to $500,000 for individuals and more than $10 million for companies). Cartel conduct may also result in criminal sanctions, including gaol terms for individuals.

Sensitive Information means and includes:

(a) commercially sensitive information belonging to a Member's organisation or business (in this document such bodies are referred to as an Industry Stakeholder); and

(b) information which, if disclosed, would breach an Industry Stakeholder's obligations of confidence to third parties, be against laws or regulations (including competition laws), would waive legal professional privilege, or cause unreasonable prejudice to the Coordinator of Energy or the State of Western Australia).

Guiding Principle – what not to discuss

In any circumstance in which Industry Stakeholders are or are likely to be in competition with one another a Member must not discuss or exchange with any of the other Members information that is not otherwise in the public domain about commercially sensitive matters, including without limitation the following:

(a) the rates or prices (including any discounts or rebates) for the goods produced or the services produced by the Industry Stakeholders that are paid by or offered to third parties;

(b) the confidential details regarding a customer or supplier of an Industry Stakeholder;

(c) any strategies employed by an Industry Stakeholder to further any business that is or is likely to be in competition with a business of another Industry Stakeholder, (including, without limitation, any strategy related to an Industry Stakeholder's approach to bilateral contracting or bidding in the energy or ancillary/essential system services markets);

(d) the prices paid or offered to be paid (including any aspects of a transaction) by an Industry Stakeholder to acquire goods or services from third parties; and

(e) the confidential particulars of a third party supplier of goods or services to an Industry Stakeholder, including any circumstances in which an Industry Stakeholder has refused to or would refuse to acquire goods or services from a third party supplier or class of third party supplier.

Compliance Procedures for Meetings

If any of the matters listed above is raised for discussion, or information is sought to be exchanged in relation to the matter, the relevant Member must object to the matter being discussed. If, despite the objection, discussion of the relevant matter continues, then the relevant Member should advise the Chairperson and cease participation in the meeting/discussion and the relevant events must be recorded in the minutes for the meeting, including the time at which the relevant Member ceased to participate.

Department of Energy and Economic Diversification

GOVERNMENT OF WESTERN AUSTRALIA

Energy Policy WA

Agenda Item 4

HTR Implementation

This table provides the status of HTR Issues (as of 2 October 2025) provided by Issue Leads. Where materials have been provided by Issue Leads to support discussion at the working group meeting on 9 October 2025, a page number reference is provided.

Note. Where no status update has been received from Issue Leads, this is denoted by a dash (-), while 'no update' is used to reflect Issue Leads report.

Issue ID		Priority	Simple or Substantive	Lead	Support	Status	Page #
I3	I3	High	Substantive	Noel (Rio)	David (HP); Lekshmi (BP), James (ISO); Njabulo and Bec (BHP)	• Draft proposal paper received (25 September 2025)	P.5
	I36	Moderate	Substantive				
I4		High	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP); Noel (Rio), James (ISO)	• Has progressed to drafting (10 July 2025)	
I5	I5	High	Substantive	David (HP)	Nik (APA); Shervin and Scott (Woodside); Lekshmi (BP); James (ISO); Njabulo and Bec (BHP); Noel (Rio)	• -	
	I6	High	Substantive				
	I14	High	Substantive				
	I15	High	Substantive				
	I16	High	Substantive				
	I17	High	Substantive				

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	I19	High	Substantive				
	I34	Moderate	Substantive				
I7		High	Substantive	Nik (APA)	Njabulo and Bec (BHP); James (ISO); Noel (Rio); Lekshmi (BP)	• -	
I8	I8	High	Substantive	James (ISO)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA)	• Draft proposal paper received (1 October 2025)	P.35
	I9	High	Substantive				
	I12	High	Substantive				
I10		High	Substantive	Njabulo (BHP)	Nik (APA); David (HP)	• Has progressed to drafting (7 August 2025)	
I11		High	Substantive	Njabulo (BHP)	Nik (APA); David (HP)		
I13	I13	High	Substantive	James (ISO)	David (HP); Njabulo and Bec (BHP), Nik (APA)	• -	
	I37	Moderate	Substantive				
I18		High	Simple	Lekshmi (BP)	Njabulo and Bec (BHP)	• Has progressed to drafting (10 July 2025)	
I22		Moderate	Simple	David (HP)	Njabulo and Bec (BHP); Noel (Rio); Nik (APA)	• Has progressed to drafting (10 July 2025)	
I23		Moderate	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP)	• Has progressed to drafting (10 July 2025)	
I24	I24	Moderate	Simple	David (HP)	Lekshmi (BP); Njabulo and Bec (BHP); Noel (Rio); Nik (APA); James (ISO)	• Has progressed to drafting (10 July 2025)	
	I25	Moderate	Simple				
I26		Moderate	Simple	David (HP)	Njabulo and Bec (BHP); Nik (APA)	• Draft proposal paper received (1 October 2025)	P.39

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I27		Moderate	Simple	Nik (APA)	David (HP); James (ISO); Njabulo and Bec (BHP); Noel (Rio)	• -	
I28		High	Substantive	David (HP)	Noel (Rio); James (ISO); Njabulo and Bec (BHP), Nik (APA)	• Draft proposal paper received (1 October 2025)	P.40
I29		High	Substantive (study likely)	Peter (ISO)	David (HP); Njabulo and Bec (BHP)	• Has progressed to drafting (10 July 2025)	
I30		High	Substantive	Shervin and Scott (Woodside)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA), James (ISO)	• Has progressed to drafting (10 July 2025)	
I32	I32	Moderate	Substantive (study likely)	James (ISO)	Noel (Rio); David (HP); Njabulo and Bec (BHP), Nik (APA)	• Has progressed to drafting (10 July 2025)	
	I33	Moderate	Substantive (study likely)	James (ISO)		• Has progressed to drafting (10 July 2025)	
I35		Moderate	Substantive	Njabulo (BHP)	Nik (APA)	• Draft proposal paper received (16 September 2025)	P.42
I38		Moderate	Substantive	Njabulo (BHP)	Shervin and Scott (Woodside)	• Has progressed to drafting (7 August 2025)	
I40		Low	Simple	David (HP)	Njabulo and Bec (BHP)	• Has progressed to drafting (10 July 2025)	
I41	I41	Low	Simple	James (ISO)	Noel (Rio); Njabulo and Bec (BHP), Nik (APA)	• Has progressed to drafting (10 July 2025)	
	I42	Low	Simple			• Has progressed to drafting (10 July 2025)	
I44		Low	Simple	Noel (Rio)	James (ISO); David (HP); Nik (APA); Njabulo and Bec (BHP)	• -	
I2025.1		Moderate		Peter (ISO)	Nik (APA), Matthew (Rio)	• Draft proposal paper received (1 October 2025)	P.48

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I2025.2	High		Nik (APA)	Peter (ISO), David (HP)	• Draft proposal paper received (1 October 2025)	P.51
I2025.3	Moderate		Peter (ISO)	-	• Has progressed to drafting (10 July 2025)	
I2025.4	High		Peter (ISO)	-	• -	
I2025.5	Moderate		Peter (ISO)	-	• Has progressed to drafting (10 September 2025)	
I2025.6	High		Peter (ISO)	-	• Has progressed to drafting (7 August 2025)	
I2025.7	Low		Peter (ISO)	-	• Has progressed to drafting (7 August 2025)	

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Rio Tinto

Credible contingency event definition

Update September 2025

Recommended definition for PNR (Operational Context)

Credible Contingency Event (PNR)
A contingency event that an experienced operator, acting in accordance with Good Electricity Industry Practice, considers **reasonably possible in the prevailing system and environmental conditions.**

Without limitation, credible contingency events include:

- **The unexpected disconnection or unplanned reduction in capacity of a single generating unit;**
- **The unexpected disconnection of a single transmission element.**

A contingency event otherwise deemed non-credible may be reclassified as credible when **specific and observable threats** exist (e.g., active lightning in the vicinity of unshielded lines, bushfire encroachment on a corridor, cyclone warnings, or condition-monitoring alerts).

Classification of an event as credible does **not imply** that full redundancy must exist or be procured; rather, it indicates that **operational measures may be required** where practicable and proportionate to the risk.

Recommended definition for HTR (Planning & design context)

Credible Contingency Event (HTR)
A single contingency event of one of the following types:

- **A three-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service;**
- **A single-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service;**
- **A single-phase-to-earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault;**
- **Single-phase fault with circuit breaker failure cleared by fastest protection;**
- **The sudden disconnection of a system component, such as a transmission line or generating unit.**

Side by side comparison

Framework	Current Definition	Proposed Revised Definition (Pilbara context)
Pilbara Network Rules (PNR)	**Credible Contingency Event** means: – A contingency event identified in the Protocol Framework; or – A contingency event considered reasonably possible by the ISO Control Desk in the surrounding circumstances. Examples: unexpected disconnection or derating of a generating unit, or unexpected disconnection of a transmission element.	**Credible Contingency Event (PNR)** means a contingency event that an experienced operator, acting in accordance with Good Electricity Industry Practice, considers **reasonably possible under the prevailing system and environmental conditions**. Without limitation, credible contingency events include: – Unexpected disconnection or unplanned reduction in capacity of a single generating unit; – Unexpected disconnection of a single transmission element. A contingency event otherwise deemed non-credible may be **reclassified as credible when specific and observable threats exist** (e.g. active lightning in the vicinity of transmission lines, bushfire encroachment, cyclone warnings, condition-monitoring alerts). Classification as credible does not imply that full redundancy must exist or be procured, but indicates that **operational measures may be required** where practicable and proportionate.
Harmonised Technical Rules (HTR)	**Credible contingency event** means a single contingency event of one of the following types: a) Three-phase-to-earth fault cleared with fastest protection out of service; b) Single-phase-to-earth fault cleared with fastest protection out of service; c) Single-phase-to-earth fault cleared after unsuccessful high-speed reclosure; d) Single-phase fault with circuit breaker failure cleared by fastest protection; e) Sudden disconnection of a system component (e.g. line or generator).	A single contingency event of one of the following types: • A three-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service; • A single-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service; • A single-phase-to-earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault; • Single-phase fault with circuit breaker failure cleared by fastest protection; • The sudden disconnection of a system component, such as a transmission line or generating unit.

Considerations associated to the revised definition

Working group comments:

- **Changing the PNR definition may change the risk appetite and lead to a higher level of risk combined with greater efficiency and lower costs.**
- **PNR definition should be communicated to all stakeholders, particularly consumers.**
- **Operationally managing contingency events in real time may be complex.**
- **Consideration into how this will apply to constraint rules is necessary, more structure in how constraint rules are applied will be necessary.**
- **ESS provision may become more challenging, less ability to provision ESS well in advance and responding to dynamic system events will be required.**

Rio Tinto

Work from September 2025: Credible contingency event definition

EPNRWG HTR working group

September 2025

Recommended definition for PNR (Operational Context)

Credible Contingency Event (PNR)
A contingency event that an experienced operator, acting in accordance with Good Electricity Industry Practice, considers **reasonably possible in the prevailing system and environmental conditions.**

Without limitation, credible contingency events include:

- **The unexpected disconnection or unplanned reduction in capacity of a single generating unit;**
- **The unexpected disconnection of a single transmission element.**

A contingency event otherwise deemed non-credible may be reclassified as credible when **specific and observable threats** exist (e.g., active lightning in the vicinity of unshielded lines, bushfire encroachment on a corridor, cyclone warnings, or condition-monitoring alerts).

Classification of an event as credible does **not imply** that full redundancy must exist or be procured; rather, it indicates that **operational measures may be required** where practicable and proportionate to the risk.

Why this suits the PNR

•**Operator discretion**: gives Control Desks clear authority to classify events dynamically without fear of breaching rules.

•**Threat-conditionality**: captures the Pilbara need to only treat some risks as credible when an *active threat* exists (e.g., lightning, bushfire).

•**Cost-risk balance**: ensures “credible” does not equal mandatory N-1 build.

Recommended definition for HTR (Planning & design context)

Credible Contingency Event (HTR)
A contingency event, of a type specified below, that Network Service Providers must assume in planning, design, maintenance, and operation of their networks:

- **A three-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service;**
- **A single-phase-to-earth fault cleared by disconnection of the faulted component, with the fastest main protection out of service;**
- **A single-phase-to-earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault;**
- **A single-phase small-zone fault or a single-phase-to-earth fault followed by a circuit breaker failure, cleared by the fastest available protection;**
- **The sudden disconnection of a system component, such as a transmission line or generating unit.**

NSPs may extend this criterion to other events where network design or environmental exposure warrants (e.g., lines without overhead earth wires, high tower footing resistance), and must maintain protection and operational practices to minimise the risk of slow fault clearance.

Why this suits the HTR

- **Explicit, enumerated list**: planners and designers need concrete event sets for studies and compliance.
- **Consistency with NER S5.1.2.1 style**: aligns Pilbara with national technical standards where relevant.
- **Engineering focus**: ensures design margins and protection settings are robust to well-defined fault cases.

Side by side comparison

Framework	Current Definition	Proposed Revised Definition (Pilbara context)
Pilbara Network Rules (PNR)	**Credible Contingency Event** means: – A contingency event identified in the Protocol Framework; or – A contingency event considered reasonably possible by the ISO Control Desk in the surrounding circumstances. Examples: unexpected disconnection or derating of a generating unit, or unexpected disconnection of a transmission element.	**Credible Contingency Event (PNR)** means a contingency event that an experienced operator, acting in accordance with Good Electricity Industry Practice, considers **reasonably possible under the prevailing system and environmental conditions**. Without limitation, credible contingency events include: – Unexpected disconnection or unplanned reduction in capacity of a single generating unit; – Unexpected disconnection of a single transmission element. A contingency event otherwise deemed non-credible may be **reclassified as credible when specific and observable threats exist** (e.g. active lightning in the vicinity of transmission lines, bushfire encroachment, cyclone warnings, condition-monitoring alerts). Classification as credible does not imply that full redundancy must exist or be procured, but indicates that **operational measures may be required** where practicable and proportionate.
Harmonised Technical Rules (HTR)	**Credible contingency event** means a single contingency event of one of the following types: a) Three-phase-to-earth fault cleared with fastest protection out of service; b) Single-phase-to-earth fault cleared with fastest protection out of service; c) Single-phase-to-earth fault cleared after unsuccessful high-speed reclosure; d) Single-phase fault with circuit breaker failure cleared by fastest protection; e) Sudden disconnection of a system component (e.g. line or generator).	**Credible Contingency Event (HTR)** means a contingency event, of a type specified below, that Network Service Providers must assume in **planning, design, maintenance and operation**: – Three-phase-to-earth fault cleared by disconnection, fastest main protection out of service; – Single-phase-to-earth fault cleared by disconnection, fastest main protection out of service; – Single-phase-to-earth fault cleared after unsuccessful high-speed single-phase auto-reclosure onto a persistent fault; – Single-phase small-zone fault or single-phase fault followed by circuit breaker failure, cleared by fastest available protection; – Sudden disconnection of a system component, such as a line or generating unit. NSPs may extend this criterion to other events where **network design or environmental exposure warrants** (e.g. unshielded lines, high tower footing resistance), and must maintain protection and operational practices to minimise slow fault clearance.

Alternate combined draft definition (Pilbara Context)

Credible Contingency Event (Pilbara Definition)
A contingency event that an experienced operator, acting in accordance with Good Electricity Industry Practice, considers **reasonably possible under the prevailing system and environmental conditions.**

A credible contingency event may be:

1. **The unexpected disconnection or unplanned significant reduction in capacity of a single generating unit or major transmission element; or**

2. **A network fault of a type and location that is consistent with known equipment performance, design standards, and historical experience; or**

3. **A non-credible event reclassified as credible when specific and observable threats exist (e.g., lightning in the vicinity of transmission lines, bushfire near a transmission corridor, forecast cyclonic winds, imminent equipment failure alerts).**

In the Pilbara context, the classification of an event as credible **does not imply that full redundancy must exist or be procured,** but that operational measures should be considered where cost-effective.

Planning definitions and operational definitions should be consistent in principles but may differ in application, recognising that operational credibility assessment incorporates **real-time threat awareness.**

Current PNR

Pilbara Network Rules (current version: 18 Jun 2025)

Credible: an experienced operator (per GEIP) would consider the event reasonably possible in the surrounding circumstances.

Credible Contingency (also Credible Contingency Event): a Contingency event (i) identified in the Protocol Framework, or (ii) considered reasonably possible by the ISO Control Desk; examples include unexpected loss/derating of one operating generating unit, or unexpected disconnection of a transmission element.

Current HTR

credible contingency event: a single contingency event of specified types, including:
a) three-phase-to-earth fault (cleared by disconnection, fastest main protection out of service),
b) single-phase-to-earth fault (same assumption),
c) single-phase-to-earth fault with unsuccessful high-speed single-phase auto-reclose onto a persistent fault,
d) single-phase small-zone fault or single-phase fault followed by circuit breaker failure (cleared by fastest available protection),
e) sudden disconnection of a system component (e.g., line or generating unit).

Key difference (why the confusion happens)

- **PNR =** principle & operator-judgement based (“reasonably possible” given conditions, with examples).
- **HTR =** enumerated fault/event set used for planning/operational studies.

Key themes from existing definitions

1. Key Themes from Existing Definitions

Across Australia's AEMC, AEMO, SWIS, and other jurisdictions, a "credible contingency event" generally contains two elements:

It is a contingency event — the sudden loss, disconnection, or severe derating of a generating unit, network element, or load block.

It is deemed reasonably possible in prevailing conditions by a competent operator, considering the technical envelope, operating state, and known threats.

Common definitional points:

Examples often include loss of a single transmission element, a single generator, or certain faults (single-phase, two-phase, or three-phase depending on voltage and protection).

There is usually an explicit allowance for reclassification of events from "non-credible" to "credible" when external threats increase the likelihood — e.g., lightning, bushfire, storm fronts.

Many definitions separate planning (long-term capability assumptions) from operational (real-time threat assessment) perspectives.

There is often a default conservative list of credible events for planning purposes, but operational classification can be more dynamic.

International insights

North America (NERC):

Uses “Contingency” and “Single Contingency” concepts in transmission planning standards (TPL-001-5).

“Credibility” is linked to historical failure rates, environmental exposure, and design assumptions.

Certain rare, multiple-element events are considered “extreme events” and are planned for only if cost-effective risk mitigation is possible.

Reclassification can occur for imminent threats (e.g., wildfire encroachment, ice storm warnings).

UK (National Grid ESO):

Defines “credible” more tightly as “reasonably foreseeable” based on historical performance and system exposure.

Maintains a standard list for planning, but operational assessments can promote rare events to credible if weather/operating risks are elevated.

New Zealand (Transpower):

Uses “reasonably foreseeable” plus risk-based operational adjustments.

In an islanded or weakly meshed grid (similar to Pilbara), cost-benefit is a core consideration — expensive infrastructure to mitigate rare high-impact events is generally avoided unless benefits are clear.

Pilbara specific considerations

The Pilbara network differs from the NEM and SWIS in that:

Radial topology means loss of a single major element can cause unavoidable load loss.

No economically viable full N-1 capability for many corridors — so “planning for” and “mitigating” are not always aligned.

High-impact events may be tolerated operationally if mitigation costs exceed benefit.

The credible/non-credible classification needs to acknowledge active threat dependency — e.g., a lightning strike on a clear day is not credible, but during a thunderstorm it is.

Cost-Risk-Credibility link

A Pilbara-appropriate definition should:

Acknowledge conditional credibility — an event’s likelihood changes with prevailing environmental or operational conditions.

Allow for operational discretion — operators must be empowered to reclassify based on threats without fear of breaching the rules if they act per guidance.

Integrate cost–benefit in planning — not all credible events must be engineered out; some may be accepted with operational mitigation only.

Work from June 2024: Credible contingency event definition

EPNRWG HTR working group

June 2024

Proposal

Proposed solution or options:

1. Align with AEMC and AEMO definitions?
   – Choose AMEC or AEMO definition, or a hybrid version

2. Separate out threats from contingency events
   • Operational planning, how are credible events identified in operations, what could lead to a contingency event occurring

3. Do nothing, no changes to existing PNR and HTR

4. Combine with ISOCo consultation on Ch 7.3 and 7.4 review
   • Define pre-contingent measures using advanced weather forecasting and other tools.
   • Risk assessment ahead of and during notifiable events, and during operation

Any analysis, modelling or assessment necessary?

Framing the issue

- Costs incurred, are the costs warranted if there are no threats (a nice sunny day, is it likely a transmission line will trip?)
- Costs might be high but likelihood of the event occurring may be low. Is that acceptable?
- If consequence is high, can influence any pre-contingent activities carried out. Is the cost worth it.
- Does the operations desk have appropriate guidance to allow for these decisions to be made. How can the Operator be protected for the decisions they make, provided they are made in line with the intent of the rules. How is this guidance facilitated in an operational environment.
- Procurement of reserves, can there be guidance of what can operationally be managed without procurement of additional reserves. What can be predicable events that can inform the procurement of additional reserves. What tools/systems can be used to predict events.
- Some worked examples could be used to define some situations that can warrant the procurement of additional reserves.
- Pilbara context, Pilbara threats should be factored into the definition. Outline what the threats could be and how they trigger a credible contingency event.
- Define the principles and some worked examples to help frame the issue in the rules and operational protocols.
- Primary issue here is operational use of the term of credible contingencies. Planning requirements however do use this term and define what is planned for and which events are considered. What events feed into planning activities as credible contingencies needs to be considered in parallel. Planning and operational definitions may have some differences but should be considered in parallel.

Existing definition in PNR

Credible: In relation to an event or other thing, means that an experienced operator acting in accordance with GEIP would consider it to be reasonably possible in the surrounding circumstances.

Credible Contingency {also Credible Contingency Event}: Means a Contingency event — a) which the Protocol Framework identifies as a Credible Contingency event; or b) which the ISO Control Desk otherwise considers to be reasonably possible in the surrounding circumstances.

Without limiting the generality of this definition, examples of Credible Contingency events are likely to include — i) the unexpected automatic or manual disconnection of, or the unplanned reduction in capacity of, one operating Generating Unit; or ii) the unexpected disconnection of a Transmission Element anywhere on the Power System.

Pre-Contingent Threat: Means — a) a Credible imminent threat to the System Security Objective arising from — i) an approaching external threat (such as a storm or bushfire); or ii) impending material Equipment failure, or b) an imminent risk of physical injury or death to any person or material damage to Equipment, which can be mitigated if appropriate preparatory measures (Pre-Contingent Actions) are taken.

Existing definition in PNR - continued

(1) The Protocol Framework must set out —

(a) a list of agreed Credible Contingencies, including Credible Islanding Events and the resulting Credible Islands; and

(b) a list of Credible Network Constraints; and

(c) any communications requirements necessary to implement the Protocol Framework; and

(d) at least the following protocols —

(i) a Protocol to deal with each listed Credible Contingency; and {A single Protocol under rule 79(1)(d)(i) may deal with more than one Contingency.}

(ii) one or more protocols to deal with other contingencies, including NonCredible contingencies, multiple contingencies and an emergency being declared under State legislation; and

(iii) if judged necessary under rule 72, a Protocol to deal with any Credible Planning Criteria Interactions identified under rule 72; {Rule 72 considers the impact of the various NSPs' Network Planning Criteria on other networks in the Power System.} and

(iv) unless the ISO and Registered NSPs agree otherwise, a Protocol (the "Pre-Contingent Protocol") dealing with Pre-Contingent Threats. {The list in rule 79(1)(d) is not closed — for example, System Operations Participants may decide that there should be a Protocol to deal with system restart, or the management of certain constraints.} (2) Rule 79(1) does not limit the things a Protocol Framework may contain.

Existing definition in HTR

credible contingency event

means a single contingency event of one of the following types:

a) a three-phase to earth fault cleared by disconnection of the faulted component, with the fastest main protection system out of service;

b) a single-phase to earth fault cleared by the disconnection of the faulted component, with the fastest main protection system out of service;

c) a single-phase to earth fault cleared after unsuccessful highspeed single-phase auto-reclosure onto a persistent fault;

d) a single-phase to earth small zone fault or a single-phase to earth fault followed by a circuit breaker failure, in either case cleared by the operation of the fastest available protection scheme; or

e) a sudden disconnection of a system component, e.g. a transmission line or generating unit

AEMC definition

S5.1.2.1

Credible contingency events

Network Service Providers must plan, design, maintain and operate their *transmission networks* and *distribution networks* to allow the transfer of power from *generating units* to *Customers* with all *facilities* or equipment associated with the *power system* in service and may be required by a *Registered Participant* under a *connection agreement* to continue to allow the transfer of power with certain facilities or *plant* associated with the *power system* out of service, whether or not accompanied by the occurrence of certain faults (called *credible contingency events*).

The following *credible contingency events* and practices must be used by *Network Service Providers* for planning and operation of *transmission networks* and *distribution networks* unless otherwise agreed by each *Registered Participant* who would be affected by the selection of *credible contingency events*:

(a) The *credible contingency events* must include the *disconnection* of any single *generating unit* or *transmission line*, with or without the application of a single circuit two-phase-to-ground solid fault on lines operating at or above 220 kV, and a single circuit three-phase solid fault on lines operating below 220 kV. The *Network Service Provider* must assume that the fault will be cleared in primary protection time by the faster of the duplicate protections with installed intertrips available. For existing *transmission lines* operating below 220 kV but above 66 kV a two-phase to earth fault criterion may be used if the modes of operation are such as to minimise the probability of three-phase faults occurring and operational experience shows this to be adequate, and provided that the *Network Service Provider* upgrades performance when the opportunity arises.

(b) For lines at any *voltage* above 66 kV which are not protected by an overhead earth wire and/or lines with tower footing resistances in excess of 10 ohms, the *Network Service Provider* may extend the criterion to include a single circuit three-phase solid fault to cover the increased risk of such a fault occurring. Such lines must be examined individually on their merits by the relevant *Network Service Provider*.

(c) For lines at any *voltage* above 66 kV a *Network Service Provider* must adopt operational practices to minimise the risk of slow fault clearance in case of inadvertent closing on to earths applied to equipment for maintenance purposes. These practices must include but not be limited to:

(1) Not leaving lines equipped with intertrips alive from one end during maintenance; and

(2)*Off-loading* a three terminal (tee connected) line prior to restoration, to ensure switch on to fault *facilities* are operative.

(d) The *Network Service Provider* must ensure that all *protection systems* for lines at a *voltage* above 66 kV, including associated intertripping, are well maintained so as to be available at all times other than for short periods (not greater than eight hours) while the maintenance of a *protection system* is being carried out.

AEMC definition

CLAUSE
4.2.3
Credible and non-credible contingency events and protected events

(a)A *contingency event* means an event affecting the *power system* which *AEMO* expects would be likely to involve the failure or removal from operational service of one or more *generating units* and/or *transmission elements*.

(b)A *credible contingency event* means a *contingency event* the occurrence of which *AEMO* considers to be reasonably possible in the surrounding circumstances including the *technical envelope*. Without limitation, examples of *credible contingency events* are likely to include:

(1)the unexpected automatic or manual *disconnection* of, or the unplanned reduction in capacity of, one operating *generating unit*; or

(2)the unexpected *disconnection* of one major item of *transmission plant* (e.g. *transmission line*, *transformer* or *reactive plant*) other than as a result of a three phase electrical fault anywhere on the *power system*.

(c)[Deleted]

(d)[Deleted]

(e)A *non-credible contingency event* is a *contingency event* other than a *credible contingency event*. Without limitation, examples of *non-credible contingency events* are likely to include:

(1)three phase electrical faults on the *power system*; or

(2)simultaneous disruptive events such as:

(i)multiple *generating unit* failures; or

(ii)double circuit *transmission line* failure (such as may be caused by tower collapse).

(f)A *protected event* means a *non-credible contingency event* that the *Reliability Panel* has declared to be a *protected event* under clause 8.8.4, where that declaration has come into effect and has not been revoked. *Protected events* are a category of *non-credible contingency event*.

AEMC definition

Power system security relates to:
•the technical parameters of the power system such as voltage and frequency
•the rate at which these parameters might change
•the ability of the system to withstand faults.
The power system is secure when technical parameters such as voltage and frequency are maintained within defined limits. To maintain frequency the power system has to instantaneously balance electricity supply against demand.
The system security and reliability standards needed for a reliable and secure electricity market are defined in the National Electricity Rules and also by the AEMC's Reliability Panel. Australian Energy Market Operator (AEMO) and network businesses operate the system in line with these standards.
The ongoing challenge is determining the best ways to keep the power system stable as the generation mix changes, with a large number of wind and solar farms, and storage including pumped hydro, set to connect in coming years while older synchronous generators are retiring.
Secure operating environment
When the system is operating within the range of acceptable limits it is considered to be secure. For frequency, the optimal operation of the system is 50 cycles per second, or 50 Hertz.
A secure power system is designed to withstand a single credible contingency event.
Contingency events
A contingency event is an event that affects the power system in a way which would likely involve the failure or sudden and unexpected removal from operational service of a generating unit or transmission element.
There are two categories of contingency events.
Credible contingency events
Credible contingency events are events that AEMO considers to:
•be reasonably possible to occur
•have the potential for a significant impact on the power system.
These include:
•the loss of single element or generator
•a single phase or phase to phase line fault.
Credible contingency events can occur on transmission and distribution lines where there is short-circuiting due to:
•ionised particles
•wind causing conductors to clash
•pollution of insulators due to salt or dirt build-up
•mechanical failure due to cracking, tower damage
•lightning.
They can also occur on transformers where internal insulation failure can lead to pressure build up due to:
•insufficient maintenance (oil)
•age
•manufacturing problems
•the power system not being satisfactory (high voltages and overloads).
Generators can also be the cause of credible contingency events due to:
•mechanical problems due to interruption in the fuel supply
•electrical insulation failure or overloading/overheating.
Non-credible contingency events
Non-credible contingency events are contingency events other than credible contingency events. These are generally considered to be events that are rare in occurrence, such as the combination of a number of credible contingency events occurring at the same time.
AEMO can re-classify non-credible events as credible when the risk of rare events more becomes likely, including during extreme weather such as bushfires or storms.
Protected events
Through its Power System Frequency Risk Review, AEMO is required to regularly and transparently assess risks to power system operation caused by events that are unlikely but would have high impacts if they were to happen.
If AEMO believes that there are more transparent and cost-effective ways of managing any of the risks it identifies it can request that the Reliability Panel declare a risk as a 'protected event.'
The Reliability Panel will then consider the net economic benefits of managing the event as a protected event. If the Panel declares a protected event, AEMO can take additional steps to proactively manage the risk.

AEMO SWIS definition

A Contingency Event is an event affecting the South West interconnected system (SWIS) which AEMO expects would be likely to involve:

a) the failure or removal from operational service of one or more energy producing units, Facilities and/or Network elements; or
b) an unplanned change in load, Intermittent Generation or other elements of the SWIS not controlled by AEMO. A contingency event is an event affecting the power system that AEMO expects would likely involve the failure or removal from operational service of one or more generating units and/or transmission elements.

AEMO is responsible for determining which SWIS events are classified as Credible Contingency Events. This is described in WEM Procedure: Credible Contingency Events.

Credible Contingency Event

A Credible Contingency Event means one or more Contingency Events, the occurrence of which AEMO considers in accordance with the WEM Procedure referred to in clause 3.8A.4 to be reasonably possible in the prevailing circumstances, taking into account the Technical Envelope. Without limitation, examples of Credible Contingency Events include:

a) the unexpected automatic or manual disconnection of, or the unplanned change in output of, one or more operating energy producing units or Facilities;
b) the unexpected disconnection of one or more major items of Network equipment; or
c) Non-credible Contingency Events reclassified as Credible Contingency Events in accordance with the WEM Procedure referred to in clause 3.8A.4.

Non-Credible Contingency Event

A Non-credible Contingency Event means a Contingency Event other than a Credible Contingency Event. Without limitation, examples of Non-credible Contingency Events include simultaneous disruptive events such as:

a) multiple Facility failures; or
b) failure of multiple items of Network equipment

https://aemo.com.au/en/energy-systems/electricity/wholesale-electricity-market-wem/wem-events-and-reports/contingency-events

NER Chapter 5

S5.1.2.1 Credible contingency events Network Service Providers must plan, design, maintain and operate their transmission networks and distribution networks to allow the transfer of power from generating units to Customers with all facilities or equipment associated with the power system in service and may be required by a Registered Participant under a connection agreement to continue to allow the transfer of power with certain facilities or plant associated with the power system out of service, whether or not accompanied by the occurrence of certain faults (called credible contingency events). The following credible contingency events and practices must be used by Network Service Providers for planning and operation of transmission networks and distribution networks unless otherwise agreed by each Registered Participant who would be affected by the selection of credible contingency events:

(a) The credible contingency events must include the disconnection of any single generating unit or transmission line, with or without the application of a single circuit two-phase-to-ground solid fault on lines operating at or above 220 kV, and a single circuit three-phase solid fault on lines operating below 220 kV. The Network Service Provider must assume that the fault will be cleared in primary protection time by the faster of the duplicate protections with installed intertrips available. For existing transmission lines operating below 220 kV but above 66 kV a two-phase to earth fault criterion may be used if the modes of operation are such as to minimise the probability of three-phase faults occurring and operational experience shows this to be adequate, and provided that the Network Service Provider upgrades performance when the opportunity arises.

(b) For lines at any voltage above 66 kV which are not protected by an overhead earth wire and/or lines with tower footing resistances in excess of 10 ohms, the Network Service Provider may extend the criterion to include a single circuit three-phase solid fault to cover the increased risk of such a fault occurring. Such lines must be examined individually on their merits by the relevant Network Service Provider.

(c) For lines at any voltage above 66 kV a Network Service Provider must adopt operational practices to minimise the risk of slow fault clearance in case of inadvertent closing on to earths applied to equipment for maintenance purposes. These practices must include but not be limited to: (1) Not leaving lines equipped with intertrips alive from one end during maintenance; and (2) Off-loading a three terminal (tee connected) line prior to restoration, to ensure switch on to fault facilities are operative.

(d) The Network Service Provider must ensure that all protection systems for lines at a voltage above 66 kV, including associated intertripping, are well maintained so as to be available at all times other than for short periods (not greater than eight hours) while the maintenance of a protection system is being carried out.

ISOCo review is under way

ISOCo notice to review subchapter 7.3 and 7.4 is under way.

This relates more to operational considerations for credible contingencies.

Pilbara ISOCo

24 May 2024

NOTICE: Review of Subchapter 7.3 and Subchapter 7.4 of the Pilbara Networks Rules

Rule 178 of the Pilbara Networks Rules (the Rules) requires the ISO periodically to conduct a review of the processes set out in Subchapter 7.3 and Subchapter 7.4 against the Pilbara electricity objective.

Subchapters 7.3 and 7.4 deal with system coordination and the notification of planned and unplanned outages. These processes commenced in October 2021 and the ISO now seeks to engage with registered NSPs, registered controllers and other interested stakeholders on the effectiveness of these processes, including:

- notification, assessment and approval process for notifiable events;
- the process for determining how and by whom a notifiable event is to be managed or mitigated, including how the system is to be configured and operated, and how contingencies are to be managed, during the notifiable event, and the role and effectiveness of the protocol framework;
- roles, responsibilities and accountability of registered NSPs, registered controllers, ISO control desk and ISO including transparency requirements; and
- the allocation of costs associated with notifiable events.

Following this review the ISO will publish and consult on a Report containing any recommended rules and procedure changes.

Proposed timing

Timing	Event
June 2024	Finalise scope of review, engage consultant and publish issues paper
July 2024	Meet with registered NSPs and other interested stakeholders and finalise Report
August 2024	Publish Report and if necessary prepare rule and procedure change proposal for submission to the Pilbara Advisory Committee.

Please contact the ISO at info@pilbaraisoco.com.au should you require more information or wish to propose issues for inclusion in the Issues Paper.

PHTR Issue 8 – Review of HTR cl. 3.7 (Requirements for the connection of storage)

1.1 Issue 8 - Classification

High priority

1.2 Issue 8 - Description

The HTR Workstream support group for Issue 8 considered solutions to the following issues:

- Consider wholistic review of the treatment of Battery Energy Storage Systems (BESS) and Inverter based generating units, including clarity on which sections of the rules apply for these generating units.
- Reference to grid-forming and grid following inverter technology may be helpful, with specific regard to the differences in the technical performance between the differing technologies. A definition here may be helpful as there doesn't appear to be a clear definition on what is grid forming, grid following, or what has virtual synchronous generator performance.
- Requirements for storage devices to provide network support services (frequency and voltage support) when operating in load/charging mode to enhance power system security/flexibility. Currently the HTR requires storage devices to act as consumer equipment when withdrawing power from the network.

Background

Version 1 of the HTR contemplates the connection of storage (including BESS) under clause 3.7.

Clause 3.7 provides for the determination of requirements by the ISO, in collaboration with the NSP, for the connection of storage facilities. However, clause 3.7 leaves the details of these requirements to the ISO and NSP in their entirety. Clause 3.7 functions as a stopgap to ensure that the HTR will serve as the head of power for some level of performance requirements applicable to storage facilities, noting that Access Seekers in the NWIS are increasingly proposing to connect this type of facility and that storage facilities are instrumental to achieving higher penetration of renewable energy in the NWIS.

By delegating the responsibility to determine performance requirements for storage works to the ISO, clause 3.7 does not provide for the same level of transparency, consistency, and rigour as other user facilities including large generating units (cl. 3.3), small generating units (cl. 3.4), LV connected inverters (cl. 3.5), and loads (cl. 3.6). The HTR is also silent on emerging technical issues such as the distinction between grid forming and grid following inverters, and synthetic inertia.

The support group for Issue 8 identified a range of options to modify and expand clause 3.7 and to use its relationship to other HTR sections to address aspects of the issues proposed by EPWA. A staged approach is strongly recommended to prioritise a solution which can be implemented quickly via specific changes to the HTR and serve for the short to medium term, without prejudicing the development of a long-term solution.

Table 1 - Options

Short-medium term solution	Long term solution
Continue to utilise clause 3.7 to allow NSP and ISO to define performance requirements for BESS by leveraging clause 3.3.	Rewrite clause 3.7 to include comprehensive requirements for storage facilities.
Identify specific modifications to clause 3.3 to provide clarity to all parties on which requirements will apply to storage works.	Provide definitions in the HTR for grid forming, grid following, synthetic inertia, etc, to support drafting of requirements under clause 3.7.

The support group has opted to fully develop its proposal for the short-medium term solution with a view to achieving meaningful improvement for access and connection stakeholders as soon as possible with details provided in Table 2.

1.3 Issue 8 – Solution Options

Option 1 – Do nothing.

Doing nothing will retain the status quo with performance requirements for storage not provided to the same level of transparency, consistency, and rigour as for other user facility types. This outcome will continue existing barriers to the connection of storage facilities and to the full utilisation of their capabilities. Storage facilities are an important enabler of the EPNR's Project's decarbonisation goals for the Pilbara electricity system. Therefore, doing nothing is contrary to the EPNR Project's decarbonisation goals.

Additionally, the ad-hoc nature of clause 3.7 relies on case-by-case discretion by the ISO and NSP to connect storage facilities resulting in a less efficient connection process for storage facilities than other user facilities. Efficiency is lost due to the added uncertainty, additional work and collaboration required to coordinate assessments and testing during the connection process. The perceived lack of transparency of connection standards may also impact those seeking investment finance for storage facility projects.

Option 2 – Specific changes to HTR for a short-medium term solution.

Modifying the HTR to achieve meaningful improvements in the short-medium term requires recognition that inverter connected storage facilities share similar performance requirements to other generating units. Under Option 2, the support group proposes to extend the existing requirements for generating units under HTR cl. 3.3 to storage facilities when generating or consuming active power (i.e. discharging and charging). These changes are detailed in Table 2 and can be summarised as:

1. Providing for the ISO and NSP to treat a storage facility as a generating unit throughout the HTR.
2. Extending ride-through requirements to apply during charging and when idle.
3. Extending the voltage control requirements to apply during charging and when idle.
4. Specifying frequency control (droop) response requirements for dispatchable non-synchronous facilities.

Note that these changes will work in conjunction with the change being drafted under another issue to extend the reactive power capability curve to all 4-quadrants.

While stopping short of removing ISO and NSP discretion to determine requirements for the connection of storage facilities, adopting these changes will codify GEIP practices into the HTR and provide transparency and guidance to all stakeholders.

Option 3 – Overhaul clause 3.7 and provide definitions for a long-term solution.

Providing a comprehensive treatment of storage facilities under the HTR will require further efforts, drawing on work done under the WEM PSSR Standards Review and other jurisdictions to establish new definitions and performance requirements for grid following and grid forming inverters. Given this dependency, Option 3 is not realistically achievable within a short to medium timeframe which is needed by stakeholders to facilitate proposed connections of storage facilities.

1.1 Issue 8 – Recommended Actions

Option 2 is recommended on the merits described above and with the following considerations:

- Achieving an improvement on the existing baseline of regulation under clause 3.7.
- Doing so with a minimum of cost and timeframe.
- Doing so without prejudicing development of the long-term solution.

To implement Option 2, EPWA should adopt the following table of HTR changes developed by the support group:

Table 2- Option 2 recommended changes

Item	Change
Figure 3.3 – Inverter coupled generating unit or converter coupled generating unit	As discussed under I2025.2, the capability chart should be extended to include 4-quadrant operation. The capability chart will align to the WEM GPS A12.3 "Ideal Performance Standard" requirements and be symmetrical across the horizontal axis, i.e. the reactive power requirements will be the same whether charging or generating.
HTR 3.3.3.3 Generating unit response to disturbances in the power system	Add the following to HTR 3.3.3.3(a): "For the purpose of HTR cl. 3.7, the requirements of this clause apply to storage works when operating in charging mode and idle mode."
HTR 3.3.3.4 Sudden reduction in active power requirement	Add the following to HTR 3.3.3.4: "For the purpose of HTR cl. 3.7, the requirements of this clause apply to storage works when operating in charging mode and idle mode."
HTR 3.3.3.5 Ramping Rates	Add a subclause HTR 3.3.3.5 (c): "Storage works in charging mode must not increase or decrease its active power consumption at a rate greater than 5% of the storage works; nameplate rating per minute."
HTR 3.3.4.4 Frequency control	Replace subclause HTR 3.3.4.4(a) with: "All generating units must have an automatic variable speed control characteristic. Generating unit control systems must include facilities for both frequency and load control."
HTR 3.3.4.4 Frequency control	Remove word "synchronous" from 3.3.4.4(e)(1)(A) and 3.3.4.4(e)(1)(B).
HTR 3.3.4.4(f)(1) Rate of Response	Replace subclause HTR 3.3.4.4(f)(1) with: "For dispatchable generating units, for any frequency disturbance, the generating unit must achieve at least 90% of the maximum response expected according to the droop characteristic within (A) 6 seconds for thermal generating units (B) 30 seconds for hydro generating units (C) 2 seconds for non-synchronous generation units and the new output must be sustained for not less than a further 10 seconds."
HTR 3.3.4.5 Voltage Control System	Add a subclause HTR 3.3.4.5(j): "For the purpose of HTR cl. 3.7, the requirements of this clause for non-synchronous generating units apply to storage works when operating in charging mode."
HTR 3.7 Requirements for connection of storage	Remove wording "in respect of its injections" from HTR 3.7(b)(1): "(b) Without limiting clause 3.7(a), the NSP and ISO may choose to apply these harmonised technical rules to a storage facility by treating it: (1) as a generating unit; and (2) in respect of its withdrawals — as consumer equipment."

ISSUE 26

Hi Thomas,

The working group has reconvened to discuss this topic.

Here are the proposed drafting notes for this issue (Issue paper attached for your convenience):

- Insert into Section 3.5 the following requirements (Copy and paste relevant requirements from Section 3.4.9 and update as follows):
  - ***Remote control, monitoring and communications***
  - *(a) For inverter connected generating units (up to 1000 kVA) connected to the low voltage distribution system the generator must provide for:*
    - *tripping of the generating unit or control of generating unit real power output remotely from the NSP's control centre; and*
    - ~~*a close-enable interlock operated from the NSP's control centre; and*~~
    - *remote monitoring at the control centre of (signed) MW, MVAr and voltage.*

- For consistency, update Section 3.4.9 as follows (remove concession for non-exporting facilities):
  - **Remote control, monitoring and communications**
  - (a) ~~For generating units exporting 1 MW or more to the distribution system~~ The generator must provide for:
    - tripping of the generating unit remotely from the NSP's control centre;
    - a close-enable interlock operated from the NSP's control centre; and
    - remote monitoring at the control centre of (signed) MW, MVAr and voltage.
  - ~~(b) For generating units exporting less than 1 MW monitoring may not be required. However, where concerns for safety and reliability arise that are not adequately addressed by automatic protection systems and interlocks, the NSP may require the generator to provide remote monitoring and remote control of some functions in accordance with subclause 3.4.9(a).~~
  - (c) A generator must provide a continuous communication link with the NSP's control centre for monitoring and control for generating units ~~exporting 1 MW and above to the distribution system. For generating units exporting below 1 MW, non-continuous monitoring and control may be required e.g. a bi-directional dial up arrangement.~~
  - (d) A generator must have available at all times a telephone link or other communication channel to enable voice communications between a small power station and the NSP's control centre. ~~For generating units exporting above 1 MW,~~ A back-up speech communications channel pursuant to subclause 3.3.4.3(d) may be required.

Note that procedural related issues about when and how control instructions are issued (monitoring and control procedure) will be managed separately to the PHTR drafting.

Can you also please do a check against wording in the WEM rules to see if there are any opportunities for consistency.

Kind regards,
Dave

ISSUE 28

Thomas,

The working group has reconvened to discuss this topic. Please note that the working group has some varying views on the value of including these tables in the PHTR, so there may be some discussion at our next meeting on whether we should or shouldn't proceed with inclusion of this (Issue 28) in the final drafting.

Here are the proposed drafting notes for this issue (Issue paper attached for your convenience):

- Section 3.2.1(f) – New equipment shall meet or exceed the Short Time Withstand Currents and Short Circuit Breaking Currents in the following tables. NSPs may specify a higher requirement based on power system planning and fault level studies in accordance with Section 3.2.6, Section 5.4.1 and GEIP.
  - For equipment connected to the *transmission system*:

	System Voltage						
	330 kV	**220 kV**	**132 kV**	**66 kV**	***33 kV***	***22 kV***	***11 kV***
Short Time Withstand Current / Short Circuit Breaking Current (kA rms)	50	25	40	25	16	16	25
Short Circuit Duration (s)	1	1	1	3	3	3	3

  - For equipment connected to the *distribution system*:

	System Voltage		
	33 kV	**22 kV**	**11 kV**
Short Time Withstand Current / Short Circuit Breaking Current (kA rms)	13.1	16	25
Short Circuit Duration (s)	3	3	3

- Add footnotes to the table that:

- Consistent with the definition of *transmission system* there is sometimes equipment operated at voltages below 66kV which is used 'primarily for, or in connection with, or to control, the transportation of electricity at voltages of 66 kV or higher' and hence the need to specify minimum fault withstand ratings for equipment connected to the *transmission system* operating at voltages less than 66kV.

Can you please also check Sections 3.2.1(f), 3.2.6(a)(8), 3.4.6, and 5.4.1 to make sure there are no inconsistencies with the above?

Note that (contrary to the recommendation in the paper) we have not included any requirements around maximum fault levels as these have the potential to confuse and introduce unintended outcomes and costs. Maximum fault level planning should be covered in the procedural content around power system planning and fault level calculations.

Note that procedural related issues about when fault level calculation are required and how they are done, whilst a key issue, will be managed separately to the PHTR drafting.

Kind regards,

Dave

MEETING AGENDA AND MINUTES

Name of Meeting	Location	Date / Time	Written by
Issue 35	Online	08-09-2025 1:30-2:30 pm	Njabulo Mlilo

Attendees	Distribution
Njabulo Mlilo - BHP Peter Van Den Dolder - ISOCo Lewis Peaty - ISOCo	
Apologies	
Nik Walker - APA David Stephens – Horizon Power	

Agenda

- I35 – Special Protection schemes (SPS[1])

Meeting Minutes

Background/context

(a) Not clear if there are requirements on NSPs to enact special protection schemes to manage network congestion/instability and non-credible contingency events as required to enhance system security. However, this shouldn't be the sole option to manage security issues – network augmentation and re-dispatch are other methods by which this can be achieved.

(b) HTR silent of acceptability of special protection schemes (SPS) and management of non-credible events

(c) UFLS is used to manage non-credible events at present, however, the scheme may have limitations that may result in cascading power system elements failures leading to a system blackout e.g. high ROCOF events, post fault TOVs

Objectives

(a) Minimize likelihood of widespread network disruption when certain non-credible events occur

(b) Minimize likelihood of widespread network damage when certain non-credible events occur

Options

1. Do nothing

(a) Likely to be less rigor (on non-credible contingency that may be in blind spot) when power system studies or operational considerations are undertaken to consider and prepare mitigation measure to limit impact of non-credible contingency events.

(b) In the past Inter-tripping schemes were referenced in TR to manage significant contingencies e.g. islanding parts of the network

(c) There is a question whether current arrangements are sufficient to minimize network disruption (i.e. avoid system collapse) under extreme circumstances when intermittent renewable generation penetration increases.

2. Include new requirements in HTR – defined in the standards.

(a) Defining events and operating standards around select non-credible events (similar to 'protected events' in NEM)

(b) Bring NWIS operation and design standards in respect to high consequence non credible events in line with other NSP practices in the country.

(c) Studies on select non-credible events is advisable to understand network impact/risk, and possible mitigating protection schemes/other solutions.

3. Include new requirements in HTR – reasonable endeavors clause

(a) Reasonable endeavors approach

(b) Leave to individual NSPs to include risk assessments during studies and include mitigation as required

4. Include new requirements in HTR – Consultative approach

(a) Need for a new SPS driven by outcomes of system events investigations and recommendations by ISO.

(b) Incident investigations by the ISO under existing powers in Rule 197 to recommend classification of protected event(s) for non-credible contingencies that warrant investment in an SPS. This could provide a

[1] *SPS examples may include over frequency protections schemes, and overvoltage and under voltage protection schemes to help the power network stabilise after a non-credible contingency event.*

balanced approach to reduce risks of low-likelihood / high-consequence events but avoiding the use of ESS, constraint rules, or manual load shedding measures.

(c) The SPS investment would only be recommended where the ISO's investigation determines, in consultation with the relevant NSPs, that an SPS could reasonably be implemented and maintained, and would effectively reduce or mitigate the risk.

(d) The investigation report is to stipulate a timeframe within which the NSP must provide its decision whether to pursue the investment into the SPS. ISO will publish the NSP's decision.

Recommended option

Option 4 recommended.

Actions

Item	Discussion and Decisions	Action By	Due Date
1	Send minutes to all	NM	09/09/2025
2			
3			
4			
5			
6			
7			

Next Steps

Current WEM approach

- Requires reasonable endeavours to be taken to manage a non-credible events.

3B.3.11. For a Non-Credible Contingency Event or Multiple Contingency Event, reasonable endeavours must be taken to maintain the SWIS Frequency in accordance with the Extreme Frequency Tolerance Band, and to Stabilise and Recover the SWIS Frequency in accordance with the relevant requirements set out in Table 1, Appendix 13 for the SWIS and Table 2, Appendix 13 for an Island. For the avoidance of doubt, the use of load shedding is acceptable in order to meet the requirements of this clause 3B.3.11.

2.27A.10. AEMO must document in a WEM Procedure:

(cC) the processes and timeframes to be followed by AEMO for creating new Constraint Equations and Constraint Sets in response to a Non-Credible Contingency Event;

Current NEM approach

– Have a concept of a 'protected event' which is essentially a recognised non-credible contingency event that needs to be managed by NSP.

S5.1.8 Stability

In planning a *network* a *Network Service Provider* must consider ***non-credible contingency events*** such as *busbar* faults which result in tripping of several circuits, uncleared faults, double circuit faults and multiple contingencies which could potentially endanger the stability of the *power system*. In those cases where the consequences to any *network* or to any *Registered Participant* of such events are likely to be severe disruption a *Network Service Provider* and/or a *Registered Participant* must in consultation with *AEMO*, install, maintain and upgrade emergency controls within the *Network Service Provider's* or *Registered Participant's* system or in both, as necessary, to minimise disruption to any *transmission network* or *distribution network* and to significantly reduce the probability of cascading failure.

A *Registered Participant* must co-operate with a *Network Service Provider* to achieve stable operation of the *national grid* and must use all reasonable endeavours to negotiate with the *Network Service Provider* regarding the installation of emergency controls as described in the previous paragraph. The cost of installation, maintenance and operation of the emergency controls must be borne by the *Network Service Provider* who is entitled to include this cost when calculating the *Transmission Customer use of system* price.

S5.1.8 Stability

In conforming with the requirements of the *system standards*, the following criteria must be used by *Network Service Providers* for both planning and operation:

For stable operation of the *national grid*, both in a *satisfactory operating state* and following any *credible contingency events* or any *protected event* described in clause S5.1.2.1:

(a) the *power system* will remain in synchronism;

(b) damping of *power system* oscillations will be adequate; and

(c) *voltage* stability criteria will be satisfied.

Damping of *power system* oscillations must be assessed for planning purposes according to the design criteria which states that *power system damping* is considered adequate if after the most critical *credible contingency event* or any

protected event, simulations calibrated against past performance indicate that the halving time of the least damped electromechanical mode of oscillation is not more than five seconds.

AEMC

What is a protected event?

A protected event is a low likelihood, high consequence non-credible contingency event for which AEMO must maintain the power system security standards, including the frequency operating standards, following the occurrence of the event.

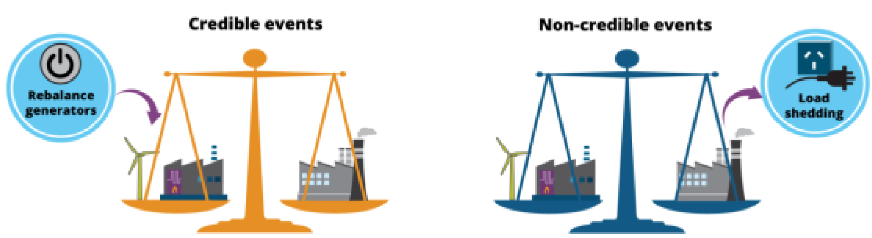
INFORMATION

Fact sheet: What is a protected event?

The AEMC's new rule introduces a mechanism to help prevent system-wide black outs. It is called a protected event.

When generation and load are not matched at all times, the power system will not be stable.

Depending on the likelihood and severity of the event causing the imbalance, AEMO has existing tools available to limit the impact of the event by bringing the system back into balance.



The new category of event - **the protected event** - allows AEMO to use power system operational tools (such as rebalancing generators) in addition to some limited load shedding, to bring the system back into balance.

What is a protected event?

A protected event is a low likelihood, high consequence non-credible contingency event for which AEMO must maintain the power system security standards, including the frequency operating standards, following the occurrence of the event.

To do so, AEMO may utilise ex-ante measures such as the purchase of frequency control ancillary services (FCAS) or constraining generator dispatch, in addition to some limited load or generation shedding, to maintain the frequency operating standards applicable to protected events.

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The introduction of a contingency event classification for protected events will allow for more efficient operation of the power system, providing security benefits for consumers.

Contingency events in the NEM

What is a credible contingency event?

From time to time, the power system may experience significant disturbances where there is a temporary and unexpected imbalance of supply and demand. These disturbances, which AEMO considers to be reasonably possible in the surrounding circumstances, are known as credible contingency events. They may be caused by events such as the loss of a single generator, a single load or a single line in the network.

Under the current rules, AEMO is required to maintain the power system frequency within the operational frequency tolerance band when these kinds of events occur, and must return the frequency to the normal operating frequency band within a specified time period. To do so, it procures contingency raise and lower FCAS, which increase or decrease the frequency in response to these more significant frequency variations.

What is a non-credible contingency event?

More rarely, the power system can experience very significant disturbances to the supply/demand balance. These events, which AEMO considers are not reasonably possible in the surrounding circumstances, are known as non-credible contingencies. They may include events such as the simultaneous loss of multiple generators, or the loss of interconnection with a neighbouring region as a result of the loss of multiple transmission circuits.

Prior to this rule being made, the rules did not allow AEMO to procure FCAS or constrain generation dispatch for contingency events that AEMO considers to be non-credible. Instead, controlled load shedding would be utilised though under-frequency load shedding (UFLS) schemes (and in some instances, special protection schemes) to limit the consequences of a non-credible contingency event.

Can AEMO reclassify events from non-credible to credible contingencies?

AEMO currently has the discretion to reclassify contingency events from non-credible to credible. This discretion allows AEMO to reclassify a non-credible contingency event when it considers that the presence of abnormal conditions means that the non-credible contingency is now more likely to occur.

AEMO publishes power system security guidelines, which set out its approach to the reclassification of credible and non-credible events. These guidelines define two scenarios that AEMO has considered for reclassification, being the presence of bushfires and lightning near transmission assets (although AEMO may reclassify in light of other threats). The guidelines then set out detailed decision making processes that AEMO will follow in these scenarios.

Why do we need the new category of contingency event?

The new category of protected event is an efficient way of limiting the consequences of certain non-credible contingency events.

Formerly, events like the loss of interconnection between two regions may have resulted in controlled load shedding. However, changing power system conditions resulting from changes in the generation mix means that there may be higher rates of change of frequency (RoCoF) levels following such an event.

The higher RoCoF means that the current equipment which facilitates load shedding may no longer be able to act fast enough to arrest the fall in frequency following this kind of event. This means that there is an increased risk that such an event could more easily trigger a major blackout (a black system event).

For a protected event, AEMO can use a mixture of ex-ante solutions, such as the purchase of FCAS or constraining generation dispatch, to maintain the power system in a configuration such that, if the event were to occur, there is a better chance that its consequences can be limited to an amount of controlled load shedding.

How does a non-credible contingency event become a protected event?

The AEMC's new rule sets out a transparent framework for the identification, declaration (or revocation) and management of a protected event.

The inclusion of an economic assessment allows for the severity of the consequences of certain non-credible contingency events to be balanced against the price outcomes associated with managing the event.

- **Power system frequency risk review** – AEMO must undertake a review of power system risks associated with non-credible contingency events at least every two years. This is a collaborative exercise with TNSPs. The review must include a review of non-credible contingency events and possible management options.
- **Request for protected event declaration (or revocation)** – AEMO must develop and submit to the Reliability Panel a request for the declaration (or revocation) of a non-credible contingency event as a protected event in accordance with the outcomes of the power system frequency risk review.
- **Declaration (or revocation) of a protected event –** the Reliability Panel must, following a request from AEMO, undertake an economic assessment of the costs and benefits to the community of managing the non-credible contingency event as a protected event. Where the benefits of managing the event outweigh the costs of doing so, the Reliability Panel will declare the non-credible contingency event a protected event. The outcomes of the assessment include the declaration (or revocation) of a protected event and the determination of the target capabilities to apply to any new of modified emergency frequency control scheme where such a scheme is part of the management strategy of the protected event.
- **Management of a protected event** - Once a new or modified emergency frequency control scheme has been implemented in accordance with the target capabilities set by the Reliability Panel, AEMO will be able to manage the power system at all times, through the use of ex-ante measures such as FCAS or constraining generation dispatch, to maintain the frequency operating standards applicable to protected events, should the event occur.

Why does the Reliability Panel have a role in protected events?

Certain non-credible contingency events, if left unmanaged, could have significant impacts on the community, particularly where the result is a major black-out. The protected event framework allows AEMO to operate the system to limit the consequences of these types of events should they occur. However, this also comes at a cost to consumers, namely through the costs associated with AEMO buying frequency control ancillary services, or through higher electricity prices caused by AEMO constraining output from generators.

The Reliability Panel is the appropriate body to undertake the cost benefit assessment necessary to determine whether it may be economically efficient to maintain the power system within the frequency operating standards applicable to protected events, should the event occur. Where the benefits of managing the event outweigh the costs of doing so, the Reliability Panel would declare the non-credible contingency event a protected event.

This is similar to its existing functions in determining various NEM standards, which require it to exercise its judgement and make economic trade-offs to determine an efficient standard.

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30 March 2017

1. PHTR Issue I2025.1 – Review of HTR cl. 2.2.2(c) (varying voltage operating standard by agreement)

1.1 Issue I2025.1 - Classification

High priority

1.2 Issue I2025.1 - Description

HTR 2.2.2(c) enables an NSP to agree alternative voltage targets with a controller for a point on the network. This may change the fundamental voltage operating standard for that part of the network for all future connections. It seems inappropriate for an NSP to have this power.

Background

HTR clause 2.2.2(c) has its roots in the Western Power Technical Rules and came from a need to manage compliance with voltage operating standards for Low Voltage (LV) networks. The normal voltage operating range for LV systems is +/-6% of nominal voltage (HTR 2.2.2(a)(1), while for transmission and distribution systems operating at 6.6 kV and above the range is 90-110% of nominal voltage (HTR 2.2.2(a)).

It was found by NSPs to be difficult and, at times impossible, to maintain the LV system within +/-6% of nominal voltage if the upstream Medium Voltage (MV) or High Voltage (HV) system was allowed to operate at or close to the lower boundary of its permitted voltage operating range. A tighter voltage operating range was often agreed for the MV or HV system with relevant operators, to ensure the LV system's voltage was maintained within +/-6%.

The LV systems which typically supply larger numbers of small industrial and residential customers. Unlike MV and HV customers who typically own and operate transformers with tap changers, these LV customers typically do not have control over the voltage levels at the point of supply.

These agreements are prolific in the NWIS and the NSPs in the NWIS rely on this HTR clause (or similar clauses in their own Technical Rules) to deliver a high quality of supply to their LV customers.

Issue

Notwithstanding the good uses of this clause as described above, this clause in its current form appears to enable an NSP to agree alternative voltage targets with a controller for a point on the network, that may change the fundamental voltage operating standard for that part of the network for all future connections.

If true, it is inappropriate for an NSP to have this head of power in its current form:

- A more onerous (narrower) target voltage range at a connection point may, due to power system physics, spill over into a wider portion of the NSP's

network, potentially creating barriers of entry for future connection applicants seeking to connect in the area.
- Any alternative voltage standards agreed under this clause would need to be accounted for in all future grid connection studies. This is expected to create significant administrative burden.
- The network performance standards of Chapter 2 comprise the Technical Envelope defined in PNR Rule 163 and are fundamental standards that should not be easily changed. Changes to the technical envelope for part of an NWIS network should be transparent.
- The clause in its current form could be used to lower the burden to connect for the first applicant to accommodate a technical limitation of its equipment and avoid an exemption, while at the same time increasing the burden to connect for a future applicant whose equipment or design may rely on the HTR's default voltage operating range.
- The clause does not require an NSP to consult with NSPs of neighbouring networks which may be impacted by the adjusted normal voltage operating range.

1.3 Issue I2025.1 – Solution Options

Option 1 – Do nothing.

- The clause may potentially be used to advantage first-mover connection applicants while increasing the burden to connect for future applicants seeking access in the same part of the network.

Option 2 – Amend HTR cl. 2.2.2(c) to address deficiencies of the clause and ensure transparency and coordination between NSPs:

1. Introduce a new subclause HTR 2.2.2(d) to clarify that any agreement made in reliance on clause 2.2.2(c) does not alleviate a user's obligations to meet the technical capability requirements for user facilities detailed in Section 3 of the HTR.
2. Introduce a new clause 2.2.2(e) to require an NSP who has made an agreement or otherwise maintains operational practises in reliance on clause 2.2.2(c), to notify the ISO of, and if the matter relates to a covered network, publish the details of the resultant voltage operating range, including at minimum, details of the new voltage range being operated and the network elements to which the new voltage range applies.

   NOTE: The obligation to publish should apply to covered NSPs only as non-covered NSPs are not obliged to facilitate third-party access. Quality of supply arrangements for third parties on non-covered networks are managed through other mechanisms (e.g. state agreements, NQRS, bilateral contracts).
3. Introduce a new clause 2.2.2(f) requiring an NSP who is contemplating an agreement or operational practise in reliance on 2.2.2(c), before doing so, to consult with all registered NSPs that are directly connected to its network.

Option 3 – Review and amend the clause as required to ensure use of the clause does not and cannot impact the Technical Envelope or reduce connection standards.

1. Conduct a legal review of the implications of agreements made under the clause on the Technical Envelope and connection standards as defined in Section 3 of the HTR.
2. If required, amend the clause to retain the ability of NSPs and controllers to enter into operational agreements, while removing the impact of such agreements on the Technical Envelope and connection standards of section 3 of the HTR.

1.1 Issue I2025.1 – Recommended Actions

Option 3 is recommended on the merits described above and with the following considerations:

- Option 2 was considered to present an excessive administrative burden on NSPs who may enter into or alter operational agreements under HTR 2.2.2(c) on a regular basis.
- The key concerns listed in section 2.1 are contingent on an accurate legal understanding of the impact of agreements made under HTR 2.2.2(c) on the technical envelope as defined in PNR Rule 163 and on the connection standards of HTR section 3.
- A thorough legal review of those linkages may determine that agreements under HTR 2.2.2(c) do not present the risks outlined in section 2.1, in which case it may be sufficient to add some drafting notes or small edits to HTR 2.2.2 to clarify this.

1. PHTR Issue I2025.2 – Review reactive power capability of inverter-based generating units, to ensure HTR requirements are technology agnostic as far as possible

1.1 Issue I2025.2 - Classification

High priority

1.2 Issue I2025.2 - Description

HTR c. 3.3.3.1 stipulates reactive power capability requirements of synchronous, induction and inverter coupled generating units, summarised in the table below.

Generation Technology	HTR clause	Lagging power factor (Q supply)	Leading power factor (Q absorption)
Synchronous	3.3.3.1(c)(1)	0.8	0.9
Induction	3.3.3.1(c)(2)	0.95	0.95
Inverter coupled	3.3.3.1(c)(4)	0.95	0.95

Industry decarbonisation goals and government mandates are expected to drive significant investment in asynchronous, inverter-based generating facilities that are expected to displace the existing synchronous generation.

It is important to maintain reactive power reserves as inverter-based generation displaces synchronous (thermal) generators. For example, the NWIS already experiences significant challenges in managing excess reactive power during very low load conditions (e.g. Pre-cyclone conditions), despite the prevalence of thermal generators with reactive capabilities of 0.9 lagging to 0.8 leading.

Broad reactive power capability requirements may be justified for the NWIS due to the ratio of net transmission line length to net system load, which is much higher than other jurisdictions like the WEM and NEM. Long transmission lines between load/generation centres and extensive underground distribution systems in Port Hedland and Karratha, generate substantial amounts of reactive power compared to the number of generating facilities on the system.

1.3 Issue I2025.2 – Solution Options

Option 1 – Do nothing.

- New inverter-based generation would continue to displace existing synchronous generation and, over time, could lead to a reduction in the system's capacity to manage reactive power requirements for system stability.
- The clause may advantage first-mover connection applicants who connect under (relatively) lax connection standards while the system has abundant reactive power reserves, but who rapidly deplete those reserves by the act of connecting, thereby increasing the burden of connecting for future applicants.
- The clause in its current form is not considered technology agnostic, requiring a broader reactive power capability from synchronous generators.

Option 2 – Align reactive power capability standards with ideal standards of other jurisdictions in Australia.

- Western Australia's Wholesale Electricity Market (WEM) of the South-West Interconnected System (SWIS) has applied a single connection standard for all generation technology types[1]. Similarly, the National Electricity Market (NEM) Rules have a single standard for all types of generation systems[2].
- The ideal standards of the WEM specifies a 0.9 lagging to 0.9 leading power factor for all types of generation systems, including inverter-based and induction generation technologies. Bringing this across to the NWIS is not expected to present barriers for connection to project developers with experience in Western Australia, given their familiarity with these requirements in the SWIS.
- The ideal standards of the WEM are an improvement on the existing reactive power capability standards of the HTR.
- Specifically, this option proposes the following changes to the HTR:
    - Remove HTR clauses 3.3.3.1(c)(2) to (4).
    - Replace HTR 3.3.3.1(c)(1) with the following text:
      "Each *generating unit* must be capable of supplying or absorbing *reactive power* continuously of at least the amount equal to the product of the notified maximum *active power* output of the *generating unit* at nominal voltage and 0.484 while operating at any level of *active power* output between its maximum *active power* output and its notified minimum *active power* output level."
    - Replace HTR 3.3.3.1(c)(2) as follows:
      "Where necessary to meet the performance standards specified in clause 2.2, the NSP and the generator may agree that a *generating unit* is to be capable of supplying or absorbing a greater amount of *reactive power* output than specified in subclause 3.3.3.1(c)(1). The need for such a requirement will be determined by power system simulation studies and any such a requirement must be included in the access contract."

[1] See clause A12.3 of [electricity_system_and_market_rules_27_september_2025.pdf]

[2] See clause S5.2.5.1 and definition of 'schedule 5.2 plant' in [NER Version 235 Summary - AEMC Energy Rules]

Option 3 – Develop NWIS-specific reactive power capability requirements by considering the unique characteristics of the NWIS, existing system operational scenarios, credible system growth scenarios, and technology trends:

- The unique characteristics of the NWIS, comprised mostly of large industrial load centres separated by long transmission lines, and situated within high cyclone risk areas, may warrant broader reactive power capability standards than other jurisdictions.
- Specifically, the NWIS has the unique feature of experiencing 2-4 day periods of extremely low load, potentially several times per year, due to the impacts of cyclone readiness actions by mining and port operations. Managing reactive power levels during these events has already proven challenging[3].

1.1 Issue I2025.2 – Recommended Actions

Option 2 is recommended on the merits described above and with the following considerations:

- The displacement of synchronous generation with inverter-based generation may occur at a uniquely rapid pace in the NWIS, due in part to a relatively small difference between efficient generation project size and total system load. In the short term, adopting WEM standards should be amenable to industry while beginning to mitigate the risks described above.
- The proposal creates an equitable playing field for all generation technology types.
- Option 3, while potentially more sustainable in the long term, requires a longer design and consultation period. In the medium-long term, and based on the EPWA's EPNR proposals, it is expected the HTR will have a negotiation framework similar to the WEM Rules, including a minimum performance standard which might differ from this proposed standard. It is recommended to conduct more detailed work and consultation to confirm an NWIS-specific performance standard, especially with respect to reactive power absorption during periods of extremely low load (cyclones), when developing the HTR negotiation framework.
- It is noted this proposal (Option 2) is made in the context of other relevant and immediate changes coming to the HTR, and the rule change should be drafted in consideration of those changes, including:
    - Four-quadrant reactive power capability curve for storage facilities
    - Temperature dependency mechanism for reactive power capability
    - Various issues dealing with reactive power control and testing requirements
    - Expansion of the use of the term "generating unit" in the HTR to apply to inverter-based facilities at the connection point to a registered network.

[3] Refer to the management of cyclone Zelia on 13/02/2025 in System Coordination Bulletin Volume 7.0