Department of Energy, Mines, Industry Regulation and Safety
Energy Policy WA
GOVERNMENT OF WESTERN AUSTRALIA

Meeting Agenda

Meeting Title:	Evolution of Pilbara Network Rules Working Group
Workstream	Workstream 2 (HTR Workstream)
Date:	28 August 2024
Time:	9:30am – 11:30am
Location:	Online, via TEAMS

Item	Item	Responsibility	Type	Duration
1	Welcome and Agenda • Conflicts of interest • Competition Law	Chair	Noting	4 min
2	Meeting Apologies and Attendance	Chair	Noting	1 min
3	Minutes of Meeting 2024_07_11 Published 15 August 2024	Chair	Noting	1 min
4	Action Items	Chair	Noting	4 min
5	Intent of the HTR, and options for negotiation and dispute resolution	Chair	Discussion	15 min
6	HTR Issue List: **a)** Proposals for high priority simple issues (Issues 4 and 18) **b)** Proposals for high priority substantive issues (Issues 3, 5, 7, 8, 10, 11, 13, 14, 16, 28, 29 and 30) **c)** Options/proposals for Issue 38	Chair Issue Leads	Discussion	1h 25 min
7	Next steps	Chair	Noting	10 min
	Next meeting: 9:30 AM,10 October 2024 (HTR workstream)			

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.

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Agenda Item 4: Action Items

Evolution of the Pilbara Networks Rules Working Group (EPNRWG) Workstream 2 – Meeting - 2024_08_28

Shaded	Shaded action items are actions that have been completed since the last EPNRWG (WS2) meeting. Updates from last EPNRWG (WS2) meeting provided for information in RED.
Unshaded	Unshaded action items are still being progressed.

Item	Action	Responsibility	Meeting Arising	Status
4/2024	Clarify the intent of the HTR to provide a single, complete set of end-to-end standards and develop options for negotiation framework for deviations from the standard, including for early resolution of disputes.	EPWA	2024_07_11	**Open** This topic will be progressed in Agenda Item 5.
5/2024	Prepare proposals addressing high priority issues from the HTR List, for presentation at the next meeting of the HTR Workstream.	Issue Leads	2024_07_11	**Completed** Issue leads to provide update during Item 6.

Note. Action items are removed from this register after they have marked and presented as 'completed'.

Government of **Western Australia**
Energy Policy WA

Evolution of the Pilbara Network Rules – HTR Working Group

Meeting 2024_08_28

28 August 2024

Working together for a **brighter** energy future.

Purpose of the Harmonised Technical Rules

Historically, different networks in the Pilbara had different technical standards. Each network operator set the technical requirements for connecting to and operating on its network. The Pilbara Network Rules introduced a common framework for the interconnected networks making up the NWIS. Appendix 5 of the PNR is the Harmonised Technical Rules.

The HTR are intended to function as a single, end-to-end technical power system standard for all networks and equipment connected to the NWIS. They are intended to supersede technical rules for different networks, and provide a single standard across all parts of the interconnected network.

Networks and network equipment that connects to the NWIS in future is expected to meet the HTR and operate in accordance with them. Where there are gaps in the HTR, it is EPWA's intention that they are filled, so that the HTR provide a complete set of common technical standards for the NWIS.

The HTR will set a default standard for "automatic qualification", whereby any prospective connection that meets the standard is automatically eligible for connection. Network operators will not have a right to place conditions or restrictions on operation that apply higher standards than the HTR.

Departures from the HTR

While compliance with the HTR is sufficient for connection to be allowed, sometimes a prospective connection or a network may wish to depart from the standard. For example, a new connection may wish to not comply with some portion of the HTR, or a network operator may prefer compliance with a higher standard than required in the HTR. In either case, the relevant parties would need to agree to negotiate such a departure.

In addition to the default (or “atomistic”) standard, the HTR could also set a minimum standard:

- Below which connection and operation is not permitted.
- Above which (if also below the default standard) the prospective connection can seek departure from the default standard from the network operator and the ISO.

With or without a minimum standard, the PNR needs to include a mechanism for negotiation, transparency, and ongoing monitoring of departures from the HTR, including supporting dispute resolution process. Ideally, the PNR will be structured to avoid disputes, and to resolve them early if they do arise.

The framework for negotiation will be part of the main PNR, and will be included for comment in a consultation paper published later this year.

Proposed negotiation framework (1)

If a prospective connection meets the default standard, no negotiation is required, and no additional conditions can be required by the network operator. This is the main mechanism for avoiding disputes.

If a connection applicant wishes to not meet the default standard, it must request this through the connection process. In this case the network operator and/or the ISO must negotiate with the access seeker to attempt to agree an acceptable solution that at least meets the minimum standard. The HTR could specify circumstances under which an access seeker could deviate from certain requirements of the default standard (or evidence that it must provide), or that could be left to the negotiation process.

Required timings for acceptance or formal counter-proposal should be included in the connection process, with maximum times (in days or weeks) specified for responses to formal submissions or requests. This should allow discussion to progress, and ensure differences are surfaced early in the process.

Proposed negotiation framework (2)

A network operator can request that an applicant meet a higher standard than specified in the HTR, but if the applicant rejects the request, no further negotiation is necessary, as an applicant that meets the automatic standard has the right to connect.

All parties should be acting in good faith. If parties are unable to reach agreement, including on whether a prospective connection meets the default standard, or has provided sufficient evidence, it may be necessary to seek resolution from another body. If the ISO is not a party, they could be the arbitrator, or it could be referred to something like the Disputes Arbitrator for access disputes. Again, timeliness is important, so timing (in weeks or months) would need to be specified.

The final outcome of the negotiation process and any deviations from the “automatic” standard should be made transparent to the rest of the market.

What other matters should be included in the negotiation framework?

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Agenda Item 6

HTR Issues: Current status and meeting material

This table provides the status of HTR Issues (as of 20 August 2024) provided by Issue Leads. Where materials have been provided by Issue Leads to support discussion at the working group meeting on 28 August 2024, 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), Gemma (ISO); Njabulo and Bec (BHP)	• -	-
	I36	Moderate	Substantive				
I4		High	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP); Noel (Rio), Gemma (ISO)	• Update provided (see attached)	p.4
I5	I5	High	Substantive	David (HP)	Nik (APA); Shervin and Scott (Woodside); Lekshmi (BP); Gemma (ISO); Njabulo and Bec (BHP); Noel (Rio)	• Update provided (see attached)	p.5
	I6	High	Substantive				
	I15	High	Substantive				
	I17	High	Substantive				
	I19	High	Substantive				
	I34	Moderate	Substantive				

I7		High	Substantive	Nik (APA)	Njabulo and Bec (BHP); Gemma (ISO); Noel (Rio); Lekshmi (BP)	• Remains a work in progress with literature review of other jurisdictions underway with meeting of members expected mid-September.	-
I8	I8	High	Substantive	Gemma (ISO)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA)	• -	-
	I9	High	Substantive				-
	I12	High	Substantive				-
I10		High	Substantive	Njabulo (BHP)	Nik (APA)	• Update provided (see attached)	p.8
I11		High	Substantive	Njabulo (BHP)	Nik (APA)		
I13	I13	High	Substantive	Gemma (ISO)	David (HP); Njabulo and Bec (BHP), Nik (APA)	• -	-
	I37	Moderate	Substantive				-
I14		High	Substantive	Lekshmi (BP)	Gemma (ISO); Njabulo and Bec (BHP);Nik (APA)	• Update provided (see attached)	p.13
I16		High	Substantive	David (HP)	Gemma (ISO); Njabulo and Bec (BHP); Noel (Rio), Nik (APA)	• Verbal update to be provided in the meeting	-
I18		High	Simple	Lekshmi (BP)	Njabulo and Bec (BHP)	• Update provided (see attached)	p.21
I22		Moderate	Simple	David (HP)	Njabulo and Bec (BHP); Noel (Rio); Nik (APA)	• Verbal update to be provided in the meeting	-
I23		Moderate	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP)	• Verbal update to be provided in the meeting	-
I24	I24	Moderate	Simple	David (HP)	Lekshmi (BP); Njabulo and Bec (BHP); Noel (Rio); Nik (APA); Gemma (ISO)	• Verbal update to be provided in the meeting	-
	I25	Moderate	Simple				-

I27	Moderate	Simple	Nik (APA)	David (HP); Gemma (ISO); Njabulo and Ben (BHP); Nik (APA)	• Update provided (see attached)	p.24
I28	High	Substantive	David (HP)	Noel (Rio); Gemma (ISO); Njabulo and Bec (BHP), Nik (APA)	• Update provided (see attached)	p.25
I29	High	Substantive (study likely)	Gemma (ISO)	David (HP); Njabulo and Bec (BHP)	• -	-
I30	High	Substantive	Shervin and Scott (Woodside)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA), Gemma (ISO)	• -	-
I31	Moderate	Simple	David (HP)	Njabulo and Bec (BHP)	• Verbal update to be provided in the meeting	-
I35	Moderate	Substantive	Njabulo (BHP)		• -	-
I38	Moderate	Substantive	Njabulo (BHP)	Shervin and Scott (Woodside)	• Update provided (see attached)	p.27
I40	Low	Simple	David (HP)	Njabulo and Bec (BHP)	• Verbal update to be provided in the meeting	-
I44	Low	Simple	Noel (Rio)	Gemma (ISO); David (HP); Nik (APA); Njabulo and Bec (BHP)	• -	-
I45	Low	Simple	Noel (Rio)	Gemma (ISO); Njabulo and Bec (BHP); Nik (APA)	• -	-

PHTR Issue 4 – Updated WA Voltage and Frequency Regulations

Issue #4 – Classification:

High Priority, Simple, Technical

Issue #4 – Description:

The recent Electricity Industry Amendment (Distributed Energy Resources) Act 2024 (the DER Act) will remove the voltage and frequency requirements from the Electricity Act 1945 and instead empower these settings to be addressed in regulations.

As part of these changes the new voltage settings will align with AS IEC 60038:2022, resulting in a new Low Voltage distribution network nominal voltage of 230V, with an upper limit of 254V and lower limit of 207V.

This issue deals with the alignment of the Pilbara Harmonised Technical Rules with the regulatory changes.

Issue #4 – Solution Options:

1. Update in alignment with proposed regulations *(Recommended, noting that there may be some areas which are not distribution networks where the voltage regulations may not apply)*
2. Leave as is *(Not a suitable option – inconsistent with review objectives, and not compatible with ESMR)*

Issue #4 – Recommended Actions:

- Update PHTR Section 2.2.2(a) in alignment with the proposed updates to voltage regulations, including any specific clarifications related to low voltage networks which are not distribution networks (eg within generation facilities etc).
- Update PHTR Section 2.2.10 Figure 2.1 to reflect the new upper voltage limit for LV.
- No change to frequency standards are required as a result of the new regulations as the new regulations defer to relevant Technical Rules (i.e. the PHTR).
- Check proposed wording for WEM/SWIS to ensure alignment.
- Check the scope and application of the ESMR to network operators only or more broadly.

PHTR Issue 5 – Power System Performance

System Study Scope of Works

Issue #5 – Classification:

High Priority, Substantive, Technical

Issue #5 – Description:

Issue #5 encapsulates a range of technical issues identified in the PHTR review relating to power system performance, including:

- Wholistic review of power system ride through requirements, and performance and restoration for major disturbances, including review of the target frequency recovery times under Section 2.2.1 (25 minutes at 48 Hz) may have adverse impacts on system security.
- Frequency variations - do we need to lower the single contingency event limit due to increasing penetration of renewables / less system inertia e.g. NT has 47 Hz.
- Currently requirement is for up to 4 Hz per second. This requirement has been updated in the WEM Rules.
- "Consider continuous uninterrupted operation requirements in section 3.3.3.3(h). It may not be prudent for the system if all generators follow this requirement simultaneously. Whilst a small system like NWIS might benefit from it, this needs to be confirmed with further studies. Also need to define the fault clearance time to comply to this requirement.
- This clause has been changed in the WEM Rules. Further, we note that some wind generators have not been able to meet this requirement."
- "The identified rate of response is difficult for some OEMs of non-dispatchable generating units to achieve – the current requirement is achieving 90% within 2 seconds and new output to be sustained for no more than 10 seconds.
- The minimum requirement of WEM rules (12.6) states asynchronous machines to meet 60% of the freq response in 6 seconds and 90% by 15 seconds.
- Related clauses in the WEM Rules to consider are:
  - A12.6.3.2 which provides more achievable requirements than the current Pilbara HTR.
  - A provision for negotiating the standard is requested."
- ROCOF and include df/dt for under frequency load shedding and/or under frequency islanding. Determine if df/dt is used for islanding only, or if it can apply to ufls too.
- With respect to the “Frequency Operating Standards” (2.2.1):
  - The frequency bands, particularly high frequencies, are narrow even when compared with larger grids where generation and load events are a smaller relative magnitude. The NWIS includes large loads fed via radial connections thus load events have a material impact.
  - The range does not align with the generation ride through requirements – it is narrower.
  - The section has no reference to RoCoF targets/limits
  - There is reference to UFLS but not to Over-Frequency Generating Shedding (OFGS) or load/generation inter-tripping schemes
  - Frequency measurement techniques, especially for high RoCoF, may not be suitable - is 10 cycle averaging appropriate?

– 2.2.1(d) – the wording implies a “hard limit” which does not take into account transient under/overshoot – other jurisdictions include reference to “reasonable endeavours”

The resolution of each of these issues will require investigations and power system studies to be completed.

This issue also relates to Issue #32 (Maximum Fault Clearing Times).

Issue #5 – Solution Options

Solution Options will be determined as part of the study process.

Study Scope Of Works:

The study shall include:

Study Item	Scope	Output
1	Review Critical Fault Clearing Times – CFCT study	▪ Confirm suitability of Maximum total fault clearance times in Section 2.6.4 for range of scenarios, and update if necessary.
2	Review Generator Ride Through Requirements – identify system performance for faults to define ride through requirements.	▪ Confirm suitability of generator ride through requirements in Section 3.3.3.3 for range of scenarios, and update if necessary. ▪ Confirm suitability of generator sustained operation post-fault requirements (eg frequency requirements in Section 2.2.1) for range of scenarios, and update if necessary. Do we need to lower the single contingency event frequency limit? ▪ Consider suitability of pre and post fault reactive power absorption requirements (Section 3.3.3.3(f)) ▪ Consider applicability of ride through requirements for BESS / Renewable generators, and clarify if necessary. ▪ ROCOF – confirm suitability of 4 Hz/sec rocof ride through capability under 3.3.3.3(d). Is the 4Hz/sec for inverter based generation appropriate?
3	Review System Islanding Scheme and Settings	▪ Confirm suitability of UFLS and UFIS schemes and settings in Section 2.4 for range of scenarios, and update if necessary. Can the UFLS/UFIS schemes respond in time to prevent grid collapse? ▪ Can the UFLS system be sufficient to prevent grid collapse, with the objective of keeping the system together and not needing to utilise UFIS for credible contingencies and scenario? ▪ ROCOF – could/should ROCOF be used as part of load shedding schemes?
4	Rate of Response – Step load and contingency studies	▪ Confirm suitability of Rate of Response requirements in Section 3.3.4.4(f) to maintain system frequency, for range of scenarios, and update if necessary.

5	Review of Frequency Operating Standards	▪ Review suitability of Frequency Operating Standards in Section 2.2.1 for range of scenarios and contingency events, and update if necessary. ▪ Include in the review an analysis of historical significant events within Pilbara networks. ▪ Include in the review a literature review of requirements from other jurisdictions, particularly those with high levels of inverter based and/or low inertia generation, including a review of existing (and likely future) generating unit frequency ride-through capabilities -> NSPs to share information of generation installed on their networks.

Scenarios (consider alignment with PNR workstream scenarios).

A. Existing System Scenario
B. Future System Scenario

Dispatch scenarios – consider a credible range of dispatch scenarios and load levels as required.

Fault scenarios – consider a credible range of faults and contingencies.

MEETING AGENDA AND MINUTES

Name of Meeting	Location	Date / Time	Written by
Issue 10 & Issue 11	Online	28-06-2024 2:30-3:30pm	Njabulo Mlilo

Attendees		Distribution
Njabulo Mlilo - BHP		
Nik Walker - APA		
David Stephens – Horizon Power		

Apologies

N/A

Agenda

- I10 Inverter Dynamic Performance – Oscillation Damping
- I11 Inverter Dynamic Performance – Reactive current injection/absorption during fault & recovery period

Meeting Minutes

Issue 10 Inverter Dynamic Performance – Oscillation Damping

Background/context

(a) HTR damping clause 2.2.8 wording synchronous generator technology centric.
(b) Grid following inverter connected generation does not have concept of rotor angle stability.
(c) Inverter connected generation can be a source of power system oscillations putting power system security at risk, hence there need to be requirements governing their performance.

Options

1. **Do nothing**
    a. The clause 2.2.8 lacks comprehensive clarity with treatment of inverter connected generation.

2. **Include new requirements in HTR.**
    a. Rules need to align with reality on the ground – increasing penetration of inverter-based generation in NWIS.
    b. Any performance measures applied to inverter-based generation need to be appropriate for NWIS specific network conditions.
    c. May require guidelines to define what good looks like and how that would be assessed.
    d. Clauses for damping in the rules should be technology agnostic to accommodate emerging technologies.
    e. Definition of rotor angle stability needs to be clarified further in the rules.
    f. Damping ratio requirements specification would require justification via studies – part of this work may feed into the studies stream.

3.

Recommended option

2. Include new requirements in HTR.

Issue 11 Inverter Dynamic Performance – Reactive current injection/absorption during fault & recovery period

Background/context

3. HTR clause 3.3.3.3(f) requires non-synchronous generation to terminate pre-fault absorption within 200msec, and are permitted to resume absorption 60 sec after post fault voltages stabilise. This clause does not fully utilise inverter connected generation capability to support voltage recovery during & post fault recovery period.
4. HTR clause 3.3.3.3(g) requires generation to have capability to deliver reactive power post fault sufficient to ensure connection point voltage is within the range for continuous uninterrupted operation, however, it does not quantify performance requirement for reactive current injection/absorption magnitudes to support this requirement.

Options

1. **Do nothing.**
    a. Network may fail to utilize and take advantage of full capability of inverter connected generation to support network voltage recovery during and post fault period.
    b. Clause 3.3.3.3(f) may create a pervasive situation where a complying generator does not fully support the network security even though it has capacity, and still be deemed compliant.

2. **Include new requirements in HTR**
    a. Review HTR clause 3.3.3.3(f) for relevance to NWIS.
    b. Review how this clause has been applied in NWIS for inverter-based generation.
    c. Review clauses 3.3.3.3(f) against other markets and see how it is treated and if there are lessons to be learnt.
    d. Review HTR clause 3.3.3.3(g) and consider including quantifiable measures of reactive current injection/absorption during fault and post fault.
        I. Define voltage support principles for all generators and define requirements that maximize capability/strength usage for various technologies e.g. grid forming, grid following, synchronous generators. Principles may include tunable functionality that can be customized for different locations throughout NWIS.
        II. Principles to be supported by power system studies to define required performance.

Recommended Option

2. Include new requirements in HTR

Actions

Item	Discussion and Decisions	Action By	Due Date
1	Send minutes to the group	N Mlilo	28/06/2024
2	Review and provide comments	All	Midday 01/07/2024
3			
4			
5			
6			
7			

Next Steps

Issue 10 – approach taken by others

HTR Clause

2.2.8 Oscillatory rotor angle stability

System oscillations originating from system electro-mechanical characteristics, electromagnetic effect or non-linearity of system components, and triggered by any *small disturbance* or *large disturbance* in the *power system*, must remain within the *small disturbance rotor angle stability* criteria and the *power system* must return to a stable operating state following the disturbance. The *small disturbance rotor angle stability* criteria are:

(a) The *damping ratio* of electromechanical oscillations must be at least 0.1.

(b) For electro-mechanical oscillations as a result of a *small disturbance*, the *damping ratio* of the oscillation must be at least 0.5.

(c) In addition to the requirements of subclause 2.2.8(a), the *halving time* of any electro-mechanical oscillations must not exceed 5 seconds.

WEM Rules – includes specific clause for non synchronous generation

Asynchronous Generating Systems

A12.4.2.13. A Generating System, comprised of Asynchronous Generating Units, must have a voltage and Reactive Power Control System that has a power oscillation damping capability with sufficient flexibility to enable damping performance to be maximised, with the stabilising circuit responsive and adjustable over a frequency range from 0.1 Hz to 2.5 Hz. Any power system stabiliser must have measurements of power system frequency and Active Power output of the Generating Unit as inputs.

NEM Rules approach

(4) a *generating system*, other than one comprised of *synchronous generating units*, must have a *voltage control system* that:

(i) **[Deleted]**

(ii) **[Deleted]**

(iii) **[Deleted]**

(iv) **[Deleted]**

(v) with the *generating system connected* to the *power system*, has settling *times* for *active power*, *reactive power* and *voltage* due to a step change of *voltage* setpoint or *voltage* at the location agreed under clause subparagraph (2B)(i), of less than:

(A) 5.0 seconds for a 5% *voltage* disturbance with the *generating system connected* to the *power system*, from an operating point where the *voltage* disturbance would not cause any limiting device to operate; and

(B) 7.5 seconds for a 5% *voltage* disturbance with the *generating system connected* to the *power system*, when operating into any limiting device from an operating point where a *voltage* disturbance of 2.5% would just cause the limiting device to operate;

(vi) has *reactive power* rise time, for a 5% step change in the *voltage* setpoint, of less than 2 seconds; and

(vii) has a power oscillation damping capability with sufficient flexibility to enable damping performance to be maximised:

(A) with characteristics as described in paragraph (c); or

(B) where *AEMO* has published characteristics for a *generating system* other than one comprised of *synchronous generating units*, following consultation in accordance with the *Rules consultation procedures*, with characteristics as published by *AEMO*.

ISSUE 11 BACKROUND INFORMATION

WEM Rules

Asynchronous Generating Systems

A12.9.2.5. Subject to any changed power system conditions or energy source availability beyond the operator of the Generation System's reasonable control, a Generating System comprised of Asynchronous Generating Units, for the faults referred to in clause A12.9.2.2, must have equipment capable of supplying to, or absorbing from, the Network:

(a) to assist the maintenance of power system voltages during the fault:

(i) capacitive reactive current in addition to its pre-disturbance level of at least 4% of the Maximum Continuous Current of the Generating System including all operating Asynchronous Generating Units (in the absence of a disturbance) for each 1% reduction of voltage at the Connection Point below a specified threshold level within the under-voltage range of 85% to 90% of nominal voltage, except where a Generating System is directly connected to the SWIS with no step-up or connection

NEM Rules

Asynchronous generating systems

(f) Subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control, a *generating system* comprised of *asynchronous generating units*, in respect of the types of fault described in subparagraphs (c)(2) to (4), must have *facilities* capable of supplying to or absorbing from the *network*:

(1) to assist the maintenance of *power system voltages* during the fault:

(i) capacitive reactive current in addition to its pre-disturbance level of at least 4% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% reduction of *voltage* at the *connection point* below the relevant range in which a reactive current response must commence, as identified in subparagraph (g)(1), with the *performance standards* to record the required response agreed with *AEMO* and the *Network Service Provider*; and

(ii) inductive reactive current in addition to its pre-disturbance level of at least 6% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% increase of *voltage* at the *connection point* above the relevant range in which a reactive current response must commence, as identified in subparagraph (g)(1), with the *performance standards* to record the required response agreed with *AEMO* and the *Network Service Provider*,

during the disturbance and maintained until *connection point voltage* recovers to between 90% and 110% of *normal voltage*, or such other range agreed with the *Network Service Provider* and *AEMO*, except for *voltages* below the relevant threshold identified in paragraph (h); and

(2) from 100 milliseconds after clearance of the fault, *active power* of at least 95% of the level existing just prior to the fault.

PHTR Issue 14 – Under Voltage Ride Through

Classification:

High Priority, Substantive, Technical

Description:

As part of EPNR technical working group (WG) discussions, concerns were raised that the requirement of 460ms under-voltage ride through (UVRT) is overly onerous and suggested a review of the suitability of the Pilbara Harmonised Technical Rules (PHTR) [1] clause that underpins this requirement.

A presentation circulated to WG members:

- provided the history of how the existing requirements were established,
- reviewed the requirements of national and international jurisdictions,
- considered the requirements for assessing the technical performance of the NWIS, and
- postulated an initial position of how the requirements could potentially be amended.

Historical Context

- UVRT requirements in the PHTR reflect Horizon Power's existing Technical Rules [2] requirements.
- Horizon Power's Technical Rules [2] structure and requirements are largely inherited from Western Power's Technical Rules. This is reflective of the period where both organisations were one entity (pre-disaggregation).
- Western Power's present UVRT requirements were established in 2004 [3], and the basis of the requirements is documented [4]. These requirements were supported by:
  - other jurisdictions' – System operator Nordel's[1] requirements were considered when determining whether circuit-breaker failure should apply,
  - existing generation ride through capability – Collie Power Station's capability to withstand a 0pu voltage depression for 450ms was considered, and
  - future generation ride through capability – Gas Turbine generators were assumed to be able to comply to 0pu voltage depression for 450ms.

[1] Nordel managed system operation for Denmark, Finland, Norway, Sweden and Iceland between 1963 and 2009. ENTSO-E now manages system operation for the aforementioned countries.

Broader Jurisdictions Requirements

A review was conducted on the requirements of broader jurisdictions. These requirements have been summarised in the figure below.

Note that the NEM UVRT requirement shown in Figure 1 considers the CB fail fault clearance times of NER [5] table S5.1a.2 for transmission equipment >100kV and <250kV. These clearance times are accelerated at higher voltage levels.

The NER UVRT requirement is defined in S5.2.5.4 Response to voltage disturbances which does not specifically address the fault clearance times table, but it is reasonably assumed to apply.

NERC sets US UVRT requirements [6] based on the maximum expected total fault clearance time for a zone 1 distance protection element, which is 9 cycles of the US fundamental frequency (60Hz). This contrasts with some other jurisdictions, which do consider circuit breaker failure operating times in setting the UVRT requirement.

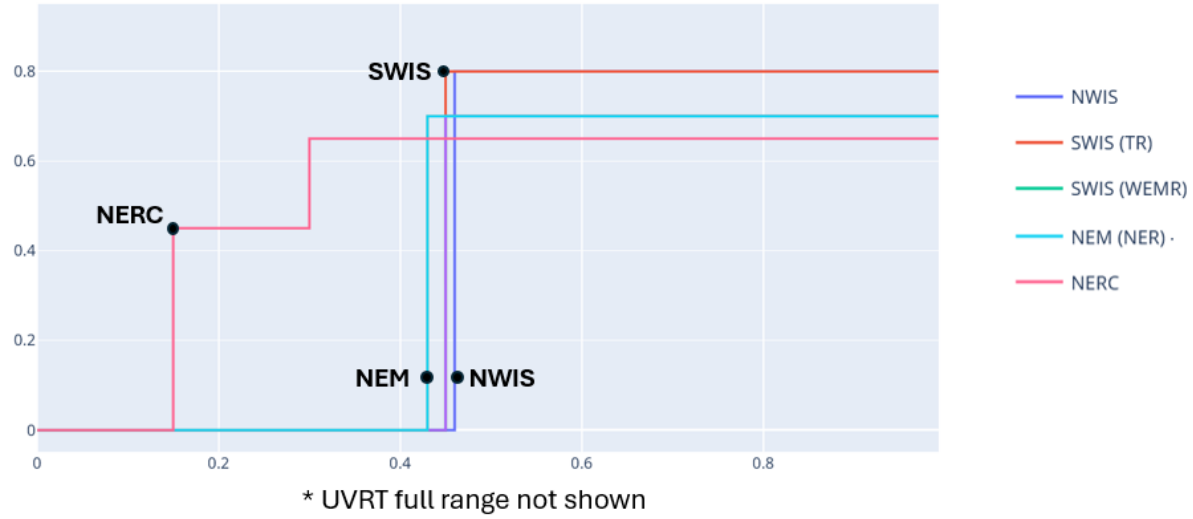

Figure 1 Overview of initial UVRT requirements for US (NERC) and Australian jurisdictions

European (ENTSO-E) requirements are defined within the codified Requirements for Generators (RfG) [7] [8], shown in Figure 2 below. UVRT profiles discriminate based on technology type.

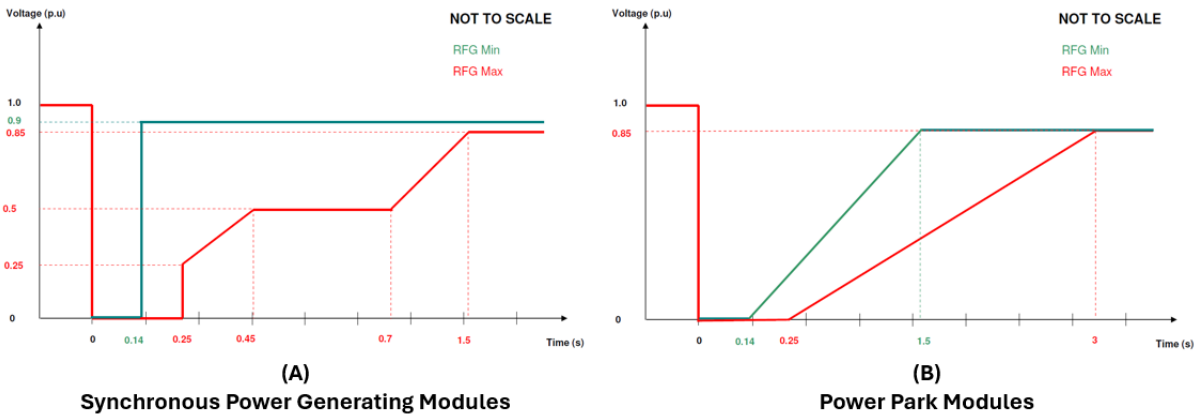

Figure 2 Overview of UVRT requirements for Type D (large) generating systems in European (ENTSO-E) jurisdictions

Maximum Total Fault Clearance Times

Maximum protection system TFCTs are dependent on various criteria including:

- type of protection used (differential, distance, overcurrent),
- interposing trip relays,
- communications latency,
- delay timers,
- circuit breakers opening time,
- modern digital relaying I/O processing and operating times, and
- any adopted safety margin.

To define the maximum TFCT, the slowest of two main protection systems is generally considered applicable. This philosophy caters for planned maintenance or failure of the fastest main protection system.

Where a circuit breaker fails to operate, backup protection systems need to clear the fault and sufficiently coordinate with other protection systems. This may result in prolonged undervoltage conditions. A generic CB fail protection application is illustrated in Figure 3 below, which shows the basic concept where a CB fail protection timer is exhausted and it is detected that one or more phases' circuit breakers did not open.

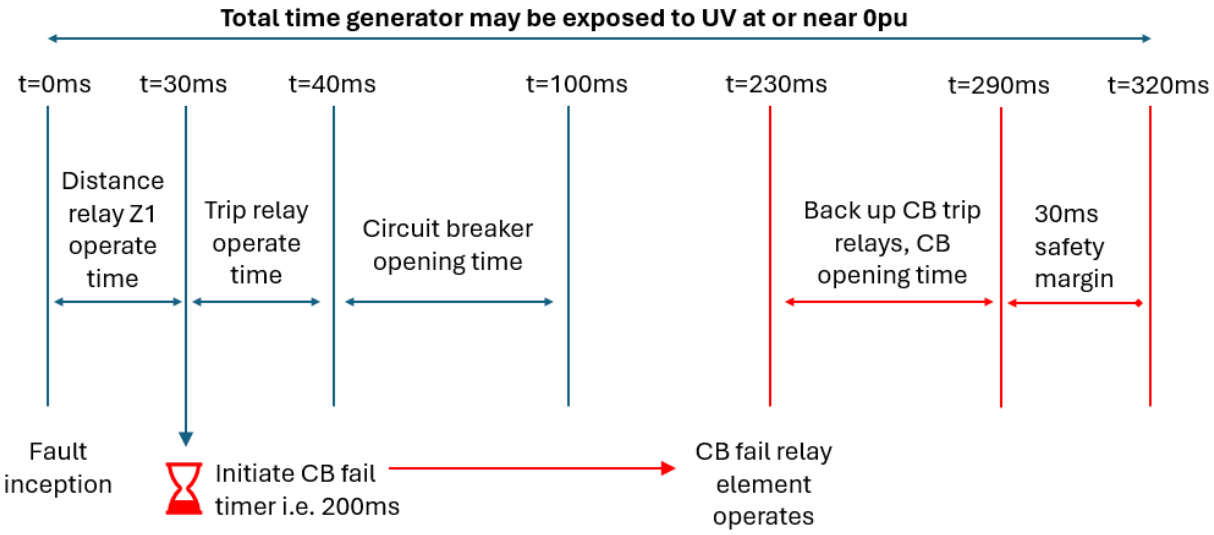

Figure 3 Generic circuit breaker fail protection system application

NWIS Performance Assessment

To assess the under-voltage performance of the North West Interconnected System (NWIS), it is necessary to understand how the existing system behaves during network transients. To conduct an analysis and inform any potential changes, the following information (at a minimum) would be required –

- Calculate existing NWIS equipment maximum total fault clearance times.
- Simulate magnitude and duration of experienced under-voltage on the existing power system.

The outcomes of these assessments would inform the:

- minimum fault-ride through that would be necessary to meet the System Security Objective
- constraints that apply across the NWIS

The suggested scope for the above assessments is described in further detail within the *pre-requisite work* section of this document.

Other Considerations

While not included in this paper's developed solution options, working group members noted the present PHTR mechanism of "complies" or "seeks exemption" does not reflect the framework existing in other Australian jurisdictions.

Most Australian jurisdictions have transitioned to generator performance standard (GPS) regimes which define minimum and ideal standards, where proponents may also seek to register a negotiated GPS between below the ideal standard (but not below minimum).

The proposed solutions in this paper consider how the UVRT requirements may be redefined, but are limited by the present PHTR structure, which would require a separate body of work to establish a flexible GPS regime. This is considered a broader issue that could be investigated by EPWA.

Related Clauses:

The following PHTR clauses are considered either:

- Directly related –the specified clause(s) inform or define UVRT requirements; or
- Indirectly related – the specified clause(s) share the same dependencies as UVRT.

Relation	PHTR Clause(s)
Direct	2.2.2 – Steady-State Power Frequency Voltage 2.6.4 – Maximum total fault clearance times 2.6.5 – Critical fault clearance times 3.3.3.3(c) – Immunity to Voltage Excursions
Indirect	3.3.3.3(e) – Immunity to High Speed Auto Reclosing 3.3.3.3(h) – Continuous Uninterrupted Operation

Related Issues:

- Issue #5 – Power System Performance – System Study Scope of Works
- Issue #8 – Application of discrete technical requirements for inverter-based resources
- Issue #33 – Review of protection system maximum total fault clearance times
- Issue #36 – Multiple-disturbance and total consecutive disturbance ride-through capability

Pre-Requisite Work:

The following engineering & power system analysis scope should be performed prior to a determination being made on the preferred option.

1) Document and establish existing protection system total fault clearance times for NWIS transmission equipment

   This scope requires each Network Service Provider and potentially some Controllers to review, calculate and document their individual protection system maximum total fault clearance times.

   As part of this scope, circuit breaker failure scenarios should also be considered, with disconnected network equipment in each CB fail scenario identified, and associated CB fail total fault clearance times calculated and documented.

2) Review of maximum total fault clearance times

   Scope to be defined by Issue #33.

   May require harmonisation of engineering philosophies and standards across NSPs.

3) Critical fault clearance time assessment

   Critical fault clearance times (CFCTs) identify the protection system clearance times which are necessary to ensure power system performance criteria are not violated. CFCTs are generally associated with a condition that leads to major system impacts, such as disconnection of generation or grid collapse. These conditions generally include voltage instability, frequency instability and loss of synchronism.

   A validated power system model of the NWIS should be used to conduct the CFCT assessment. In consultation with Network Service Providers and the ISO, the following study criteria should be defined:
   - Credible generation, load and network configuration scenarios
   - Credible fault scenarios
   - Year(s) of study
   - CFCT metrics

   CFCT assessments should be conducted without existing protection modelled.

Optimisation Opportunities

- Issue #5 – The system study scope of work should include the proposed pre-requisite work
- Issue #8 – Definition of discrete performance requirements of IBR (or asynchronous generation) should review the UVRT capability of synchronous and asynchronous generation
- Issues #33 and #36 – Maximum total fault clearance times, multiple-disturbance ride-through and consecutive total disturbance ride-through reviews have a direct relationship with this issue #14 and their outcomes should be considered in tandem

Solution Options:

With respect to UVRT, two options are envisaged to apply following completion of the *pre-requisite work*.

Option 1 – Do nothing.

The existing UVRT profile is maintained. It is expected that the present UVRT requirement:

- May be unjustified in some cases and require exemptions (where appropriate),
- May conflict with the present performance of the NWIS, and
- Should be maintained only if it is determined that OEMs' generating equipment could reasonably comply.

Option 2 – Redefine UVRT magnitude, duration and envelope shape

Based on engineering & system study outcomes, the UVRT envelope may require redefinition.

Key considerations for a redefined UVRT envelope include:

- Transmission voltage – Higher voltage equipment is generally equipped with faster protection systems, hence would likely benefit from voltage specific UVRT profiles,
- Voltage recovery profile – the system voltage recovery profile require redefinition of the UVRT envelope shape from rectangular[2] to polygonal[3], which can be seen in Figure 1 and Figure 2 respectively,
- Voltage recovery magnitudes and durations – the expected voltage depression magnitude and duration at each applicable voltage level may require redefinition,
- Equipment capability – OEMs' equipment capability to ride through should be assessed as part of industry consultation processes. This may require separate envelopes for synchronous and asynchronous generation to be defined, and
- Protection systems – a review may be conducted on whether to adopt an UVRT profile based on main protection system operation or backup protection system operation (i.e. circuit breaker fail scenario).

[2] Characterised by instant voltage recovery between voltage 'steps'

[3] Characterised by ramped voltage recovery between voltage 'steps'

Recommended Actions:

- Conduct the *pre-requisite work* scope
- Industry consultation with generator OEMs on UVRT capability (for either option)
- Determine the preferred option based on engineering & system analysis outcomes
- Harmonise requirements with related issues

The BP team wishes to thank Nik Walker of APA and David Stephens of Horizon Power for their feedback comments on the initial UVRT presentation.

References

[1] State Government of Western Australia, "Pilbara Network Rules Appendix 5 - Pilbara Harmonised Technical Rules, V1," 1 July 2021. [Online]. Available: https://www.wa.gov.au/government/document-collections/pilbara-networks-rules.

[2] Horizon Power, "Horizon Power Technical Rules - Standard HPC-9DJ-01-0001-2012 Rev 3," 15 June 2022. [Online]. Available: https://www.horizonpower.com.au/globalassets/media/documents/manuals-standards/technical-rules/hpc-9dj-01-0001-2012-horizon-power-technical-rules-nwis-nis-100820.pdf.

[3] Western Power, "Technical Code V2," December 2004. [Online]. Available: https://www.westernpower.com.au/siteassets/documents/documents-and-policies/technical-rules/electricity-transmission-access-technical-code-2004-20210505.pdf.

[4] Government of Western Australia, "Technical Rules Committee Preliminary Report," December 2005. [Online]. Available: https://www.erawa.com.au/cproot/2721/2/Complete%20Preliminary%20Report%20Dec05.pdf.

[5] Australian Electricity Market Commission, "National Electricity Rules V214," 11 July 2024. [Online]. Available: https://energy-rules.aemc.gov.au/ner/594.

[6] North American Electric Reliability Corporation, "Standard PRC-024-1 - Generator Frequency and Voltage Protective Relay Settings (Effective July 2016)," 20 March 2014. [Online]. Available: https://www.nerc.com/pa/Stand/Reliability%20Standards/PRC-024-1.pdf.

[7] European Network of Transmission System Operators for Electricity, "Requirements for Generators," 27 April 2016. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2016_112_R_0001.

[8] NationalGrid, "Fault Ride Through - ENTSO-E Requirements for Generators - Interpretation," 9 January 2013. [Online]. Available: https://www.nationalgrideso.com/document/13196/download.

PHTR Issue 18 – Frequency Control Dead Band

Classification:

High Priority, Simple, Technical

Description:

The Pilbara Harmonised Technical Rules (PHTR) [1] frequency control requires generating systems to maintain a dead band within which they provide no frequency response.

Dead band requirements are presently defined by the following –

> The dead band of a *generating unit* (the sum of increase and decrease in *power system frequency* before a measurable *change* in the *generating unit's active power* output occurs) must be less than 0.05 Hz, unless an adjustable dead band is agreed to in the *access contract*.

WG members raised a concern that the way the current requirements are written are unclear, as they do not specify how the 0.05 Hz dead band is applied. Noting that the dead band is applied on the fundamental frequency, there are few likely interpretations to how this requirement can be applied.

Lower Frequency (Hz)	Upper Frequency (Hz)	Application
49.975	50.025	These lower and upper frequency dead band limits have been applied symmetrically around 50Hz and are reflective of the present application of dead bands. This interpretation is supported by WEMR A12.6.1.9 [2], the interpretation notification issued by Western Power [3].
50.000	50.050	Proponents who seek to connect non-dispatchable generating systems may interpret that since PHTR 3.3.3.3(e)(2) stipulates no requirement to provide an active power increase for a frequency decrease, they can apply a 0.05Hz deadband between these ranges. This will result in inequitable outcomes, as dispatchable generating systems which comply with a symmetrical deadband will respond to small frequency increases, while non-dispatchable generation will not.
49.950	50.000	While a proponent could seek to apply a deadband around this range, there is no

		anticipated scenario where this would be a preferred option.

Related Clauses:

The following PHTR clauses are considered either:

- Directly related –the specified clause(s) inform or define frequency control deadband requirements; or
- Indirectly related – the specified clause(s) share the same dependencies as frequency control deadband requirements.

Relation	PHTR Clause(s)
Direct	3.3.4.4(f)
Indirect	-

Related Issues:

- Issue #8 – Application of discrete technical requirements for inverter-based resources
- Issue #12 – Requirements for storage devices to provide network support services
- Issue #19 – Frequency control rate of response for non-dispatchable generating units

Solution Options:

Two options are proposed to manage the interpretation concern.

Option 1 – Do nothing
Maintain the existing requirement.

Option 2 – Redefine the requirement

As the issue is primarily related to interpretation, the requirement could be redefined either through

a) Directly amending the clause, or
b) Addition of a clarification note

Some proponents may consider the note is informative only and does not apply, in which case (a) is recommended. The following redefinition is suggested to support this –

Existing Requirement

The dead band of a *generating unit* (the sum of increase and decrease in the *power system frequency* before a measurable change in the *generating unit's active power* output occurs) must be less than 0.05 Hz, unless an adjustable dead band is agreed to in the *access contract*.

Proposed Requirement

The dead band of a *generating unit* ~~(the sum of increase and decrease in the *power system frequency* before a measurable change in the *generating unit's active power* output occurs)~~ must

be less than or equal to ~~0.05 Hz~~ ±0.025 Hz around 50 Hz, unless an adjustable dead band is agreed to in the *access contract*.

It is expected if storage devices are required to provide frequency support services as an outcome of Issue #12, that the term "*generating unit*" would be redefined, replaced or extended with terminology that encapsulates *storage* works, or (where applicable) an entire *generating system*.

The definition of what a dead band is may be moved to the PHTR glossary.

Additional clarification is added to the magnitude of the expected dead band, and how it is applied.

Lastly, the conditions that may lead to an adjustable dead band being agreed to within an access contract should either be clarified, or this caveat removed.

Recommended Actions:

- It is recommended that Option 2 be considered for adoption

References

[1] State Government of Western Australia, "Pilbara Network Rules Appendix 5 - Pilbara Harmonised Technical Rules, V1," 1 July 2021. [Online]. Available: https://www.wa.gov.au/government/document-collections/pilbara-networks-rules.

[2] State Government of Western Australia, "Wholesale Electricity Market Rules," 27 July 2024. [Online]. Available: https://www.wa.gov.au/system/files/2024-07/wholesale_electricity_market_rules_-_27_july_2024.pdf.

[3] Western Power, "Technical Rules interpretation notification: Clause 3.3.4.4 Frequency control," 10 March 2021. [Online]. Available: https://www.westernpower.com.au/siteassets/documents/industry-resources/technical-rules-interpretation-notification-frequency-control-20210310.pdf.

PHTR Issue 27 – Pole Slip Protection

Classification:

Moderate Priority, Simple, Technical

Description:

"*Consider requirements for pole slip protection, e.g. where Critical Fault Clearance time issues exist*.", submitted by Horizon Power.

Discussion:

Meeting held on 06/06/2024 with David Stephens (HP), Njabulo Mlilo (BHP) & Nik Walker (APA) in attendance.

HTR Clause 3.4.10.2 requires pole slip protection to be applied to small generating units (up to 10MW) that connect to the distribution network. It was understood the intent of the clause relates to anti-islanding disconnection of the generator from the distribution system that is disconnected from the wider power system.

Pole slip of synchronous generator can result from (but not limited to):

- Excitation system Fault/Failure
- Power System fault not cleared within the Critical Fault Clearing Time (CFCT)
- Slow prime mover response to significant load rejection

It was noted that the use of pole slip protection is relevant for minimising network instability in response to a failure within the generating unit governing and excitation system but should not be a method of "achieving compliance" to an external system event.

This issue also relates to Issue #32 (Maximum Fault Clearing Times).

Solution Options

- Do Nothing
    - HTR Clause 3.2.5.2 does provide guidance on the generating unit protection scheme requirements, with the specific protection elements utilised subject to Good Electricity Industry Practice.
- Mandate requirement for pole slip protection on all generating units
    - This approach may be over prescriptive and add unnecessary costs.
- Update HTR to include minimum/recommended protection elements for generating units
    - It is envisaged that the update captures the requirements for different technologies (Synchronous, Grid Forming Inverters, Grid Following Inverters etc) and generating unit rating. The minimum requirements will be based upon good electricity industry practice, review of other jurisdictions' rules etc

Recommended Approach

Update the HTR to provide the minimum and recommended protection elements for majority of generating units.

PHTR Issue 28 – Review of Fault Level Management

Issue #28 – Classification:

High Priority, Simple, Technical

Issue #28 – Description:

Review of fault level management on the system:

- Consider minimum fault rating requirements for Transmission plant at significant network nodes, and fault level management.

- Consider potential requirements for limitations on maximum fault levels on the system and consider providing guidance on the calculation of fault levels. Define credible versus ultimate case.

Issue #28 – Solution Options:

Solution Options for Minimum Fault Rating Requirements:

i.e. Should there be minimum fault ratings specified for new plant? (eg 25kA/3sec for new 66kV plant)

1. No change.
   (Not recommended – disjoint approach to maintaining min fault level capability)
2. HTR – Specify Min Fault Rating Requirements
   (Recommended – seems to be some consensus that having minimum fault levels specified in PHTR would assist in managing fault level issues.
   Min fault levels to be defined at various voltage levels and consideration given to specifying levels for transmission/bulk supply substations, tie lines, generation connected substations, and distribution.
   Min fault levels should be based on readily available and commercially viable standard equipment, and derogation/alternative pathway should be available for some cases (eg at end of long radial line with low fault levels and no future prospect of fault level increases).
3. PNR/HTR – Develop process to engage/resolve. Define responsibilities.

Solution Options for Management of Maximum Fault Levels on the System

i.e. Should there be caps on maximum fault levels in the system, or should there be a process for managing maximum system fault levels, and how? (eg max allowed FL is 40kA at 132kV, or process such that new projects - increases in fault levels - must be assessed and managed)

1. No change.
   (Not recommended – would likely see fault levels exceed plant capability)
2. HTR – Specify Maximum Fault Level limits
   (Not recommended – max fault levels could fluctuate significantly, and even low maximum fault levels could exceed plant capability so a process is required rather than specified values)

3. PNR/HTR – Develop process which requires NSPs to engage other NSPs to identify and resolve maximum fault level issues for new projects and system changes. Define roles responsibilities in relation to fault level management and assessment.
   (Recommended. Note any process which governs maximum fault level management will need to be clear on how to calculate fault levels and credible operation scenarios for fault level calculations)
   Could look at sub options for where such a process resides eg HTR, PNR, Separate Procedure.

Issue #28 – Recommended Actions:

- Conduct review of fault level management options in NEM and US. *(May lead to additional or alternative options being considered)*

MEETING AGENDA AND MINUTES

Name of Meeting	Location	Date / Time	Written by
Issue 38	125 St Georges Tce, Perth	28-06-2024 1:00-2:00pm	Njabulo Mlilo

Attendees		Distribution
Njabulo Mlilo - BHP		
Abhi Pandey - BHP		
Shervin Fani – Woodside		
Scott Hiscock - Woodside		

Apologies

N/A

Agenda

- I38 UFLS integrity & transparency

Meeting Minutes

Issue background/Context.

UFLS settings appear to take a set and forget approach at present.

No clarity whether NSPs has full confidence the scheme will operate as intended when called upon.

Side issue discussed: As PV penetration increases, some Dx feeders are expected to be back feeding to the network, how are these back feeding feeders monitored and discriminated from UFLS scheme operation.

Options discussed.

(a) Do nothing.
   a. Supporting argument is that there is already a requirement for customers to self-report for any material changes in their plant/facilities.
   b. Question is whether there a CMS underfrequency setting used as backup to enable NSP to remove customer loads that may not comply during an UFLS event?
   c. Disadvantage may be that human errors or equipment malfunctions not identified if not tested periodically.

(b) Formal compliance monitoring program.
   a. Advantage is that this will put checks and balances to ensure integrity of the overall UFLS scheme.
   b. Disadvantage is that mandated annual tests may be onerous on customer operations, these may require outages that impact production revenue.

(c) Self-regulation tied to customer periodic maintenance routines.
   a. Avoid mandated outages.
   b. Testing done by customers as part of their periodic maintenance routines
   c. Accountability put on customers for UFLS settings assigned to their facilities

Recommended Option.

(c) Self-regulation tied to customer periodic maintenance routines.

Actions

Item	Discussion and Decisions	Action By	Due Date
1	Send meeting minutes to attendees	N Mlilo	28/06/2024
2	Review minutes comments	All	Midday 01/07/2024
3			
4			

5			
6			
7			

Next Steps

Background information – approach taken by others

WEM Rules clauses

3.6.10. Each Network Operator must, in respect of its Network, provide a report to AEMO on the compliance of its UFLS Specification with the UFLS Requirements:

(a) annually, on the projected ability to meet the requirements over a future ten-year horizon; and

(b) within a timeframe agreed with AEMO, both parties acting reasonably, following each under frequency load shedding event.

3.6.11. Without limiting AEMO's ability to amend the UFLS Requirements in accordance with this section 3.6, AEMO must review the UFLS Requirements to ensure they are appropriate and consistent with the requirements of this section 3.6 within three years of the date the UFLS Requirements are first published by AEMO under clause 3.6.1(b) and then at least once in every three-year period from completion of the previous review.

NEM Rules clauses

5.7.4 Routine testing of protection equipment

(a) A *Registered Participant* must co-operate with any relevant *Network Service Provider* to test the operation of equipment forming part of a *protection system* relating to a *connection point* at which that *Registered Participant* is *connected* to a *network* and the *Registered Participant* must conduct these tests:

(1) prior to the *plant* at the relevant *connection point* being placed in service; and

(2) at intervals specified in the *connection agreement* or in accordance with an asset management plan agreed between the *Network Service Provider* and the *Registered Participant*.

(a1) A *Network Service Provider* must institute and maintain a compliance program to ensure that its *facilities* of the following types, to the extent that the proper operation of a *facility* listed in this clause may affect *power system security*, operate reliably and in accordance with their performance requirements under schedule 5.1:

(1) *protection systems*;

(2) *control systems* for maintaining or enhancing *power system* stability;

(3) *control systems* for controlling *voltage* or *reactive power*; and

(4) *control systems* for *load shedding*.

Note

This paragraph is classified as a tier 1 civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

(a2) A compliance program under clause 5.7.4(a1) must:

(1) include monitoring of the performance of the *facilities*;

S5.1.10.3 Transmission Network Service Providers

Transmission Network Service Providers must:

(a) conduct periodic functional tests of the *load shedding facilities* and *emergency frequency control schemes*; and

(b) notify *Distribution Network Service Providers* regarding the settings of under-voltage *load* shed relays as determined by *AEMO* in consultation with the *Transmission Network Service Provider*.