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:	11 November 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_10_10	Chair	Noting	1 min
4	Action Items	Chair	Noting	4 min
5	HTR Issue List: • Finalise proposals for consultation paper for all open issues	Issue Leads	Discussion	1h 40 min
6	Next steps	Chair	Noting	10 min
	Next meeting: TBC			

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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Minutes

Meeting Title:	Evolution of the Pilbara Networks Rules Working Group (Workstream 2 - HTR)
Date:	10 October 2024
Time:	9:30 AM – 11:30 AM
Location:	Online, via TEAMS

Attendees	Company	Comment
Dora Guzeleva	Chair, Energy Policy WA (EPWA)	
Tim Robinson	Robinson Bowmaker Paul (RBP)	
Nik Walker	APA	
Shan Paramasibam	APA	
Njabulo Mlilo	BHP	
Rebecca White	BHP	
Lekshmi Jaya Mohan	BP	
Anthony Guevarra	CITIC Pacific Mining	
Melinda Anderson	Economic Regulation Authority	
David Stephens	Horizon Power	
WaiSoon Leong	Horizon Power	
Peter Van Den Dolden	ISOCo	
Timothy Edwards	Metro Power Company	
Noel Michelson	Rio Tinto	
Shervin Fani	Woodside	
Scott Hiscock	Woodside	
Laura Koziol	EPWA	
Luke Commins	EPWA	
Ajith Sreenivasan	RBP	
Eija Samson	RBP	
James Seidelin	RBP	

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Item	Subject
1	**Welcome** The Chair opened the meeting with an Acknowledgement of Country. The Chair noted the Competition Law Statement, reminded members of their obligations and encouraged them to bring any Competition Law issues to her attention as they may arise. The Chair provided an overview of the meeting agenda.
2	**Meeting Apologies and Attendance** The Chair noted the attendance as listed above.
3	**Minutes** The Chair noted that the minutes of the previous workstream meeting on 28 August were approved by members out-of-session and published on the EPWA website.
4	**Action Items** The Chair noted that both actions in the register have been completed.
5	**HTR Work Group Input Into Consultation Paper** • Mr Stephens enquired about the timing for publishing the Consultation Paper and whether the working group would have an opportunity to review a draft before it is provided to the Pilbara Advisory Committee (PAC). Mr Robinson clarified that the goal of the working group sessions is for members to provide specific solutions to their allocated issues and to develop consensus, to the extent possible. The Chair advised that the implementation plan may be delayed. Given the urgency of addressing certain existing HTR gaps, particularly around the connection of renewables and storage, it may be necessary to reconvene the working group to discuss interim changes to the HTR ahead of a formal implementation plan. The Chair encouraged Working Group members who have pressing concerns or suggestions to contribute to discussions at the next meeting in November. • Mr Stephens acknowledged this update and asked whether the Consultation Paper could be shared with the working group out-of-session, given the technical detail involved in the HTR issues. Mr Robinson advised that the format of the HTR and PNR workstream material will differ in the Consultation Paper. The HTR material is intended to be presented in a summary table format, outlining each issue considered, the proposals to address them, and references to relevant working group materials available on the EPWA website. The Chair added that, given this approach, she did not anticipate any surprises for Members or significant opportunities for further input from the working group at that stage. She agreed that EPWA would share a draft of the relevant section with the working group for a short period and a quick turnaround before the full paper is provided to the PAC chair.
	ACTION: EPWA will circulate a draft of the HTR content to the working group (out-of-session) for a short period and a quick turnaround before the full paper goes to the PAC.
6	**HTR Issues List – Updates from issue leads**

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Item	Subject
	Mr Robinson facilitated a discussion on all Issues listed in the 'Work Plan Under Development' worksheet in the HTR meeting workbook (circulated 3 October 2024). While work on most issues is progressing, two specific actions were recorded to assist with project management. An updated copy of the HTR meeting workbook reflecting the outcomes of the 10 October meeting was shared and finalised with Members out-of-session and will be published alongside these Minutes as a record of the meeting.
	ACTION: ISOCo will review whether the ISO has the technical capability and can request the funding to conduct scenario-building and studies of the current and future NWIS system's ride through requirements.
	ACTION: APA will provide notes, clarifying its concerns regarding adequacy and compliance with black start, frequency and voltage obligations.
7	**Next Steps** The Chair requested that Issue Leads work with their teams to finalise working group papers containing any proposals and recommendations and to send these issue papers to EPWA by close of business on 6 November 2024.
	ACTION: Finalise Issues Papers with proposals to address remaining HTR Issues and submit to EPWA by close of business on 6 November 2024.

The Chair closed the meeting closed at 11:32am.

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Agenda Item 4: Action Items

Evolution of the Pilbara Networks Rules Working Group (EPNRWG) Workstream 2 – Meeting - 2024_11_14

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
11/2024	EPWA will circulate a draft of the HTR content to the working group (out of session) before sharing with the PAC.	EPWA	2024_10_10	**Open**
12/2024	ISOCo will review whether the ISO has the technical capability and can request the funding to conduct scenario-building and studies of the current and future NWIS system's ride through requirements.	ISO	2024_10_10	**Completed** ISOCo has provided notes with their submissions and can discuss as part of Issue 5 discussions in Item 5.
13/2024	APA will provide notes, clarifying its concerns regarding adequacy and compliance with black start, frequency and voltage obligations.	APA	2024_10_10	**Open**

Item	Action	Responsibility	Meeting Arising	Status
14/2024	Finalise Issue Papers outlining options and any recommendations for working group consideration, and a provide a copy to EPWA by close of business 6 November 2024.	Issue Leads	2024_10_10	**Completed**

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

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Agenda Item 5

HTR Issues: Current status and meeting material

This table provides the status of HTR Issues (as of 7 November 2024) provided by Issue Leads. Where materials have been provided by Issue Leads to support discussion at the working group meeting on 14 November 2024, a page number reference is provided.

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)	• Updated provided (see attached)	P.5
	I36	Moderate	Substantive				
I4		High	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP); Noel (Rio), James (ISO)	• Updated provided (see attached)	P.6
I5	I5	High	Substantive	David (HP)	Nik (APA); Shervin and Scott (Woodside); Lekshmi (BP); James (ISO); Njabulo and Bec (BHP); Noel (Rio)	• Updated provided (see attached)	P.7
	I6	High	Substantive				
	I15	High	Substantive				
	I16	High	Substantive				
	I17	High	Substantive				
	I19	High	Substantive				
	I34	Moderate	Substantive				
I7		High	Substantive	Nik (APA)	Njabulo and Bec (BHP); James (ISO); Noel (Rio); Lekshmi (BP)	• Updated provided (see attached)	P.11

I8	I8	High	Substantive	James (ISO)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA)	• Updated provided (see attached)	P.13
	I9	High	Substantive				P.15
	I12	High	Substantive				P.18
I10		High	Substantive	Njabulo (BHP)	Nik (APA); David (HP)	• Closed. Previously agreed proposal can be included in consultation paper.	-
I11		High	Substantive	Njabulo (BHP)	Nik (APA); David (HP)		
I13	I13	High	Substantive	James (ISO)	David (HP); Njabulo and Bec (BHP), Nik (APA)	• Updated provided (see attached)	P.20
	I37	Moderate	Substantive				P.26
I14		High	Substantive	Lekshmi (BP)	James (ISO); Njabulo and Bec (BHP);Nik (APA)	• Closed. Previously agreed proposal can be included in consultation paper.	-
I18		High	Simple	Lekshmi (BP)	Njabulo and Bec (BHP)	• Closed. Previously agreed proposal can be included in consultation paper.	-
I22		Moderate	Simple	David (HP)	Njabulo and Bec (BHP); Noel (Rio); Nik (APA)	• Updated provided (see attached)	P.29
I23		Moderate	Simple	David (HP)	Nik (APA); Njabulo and Bec (BHP)	• Updated provided (see attached)	P.31
I24	I24	Moderate	Simple	David (HP)	Lekshmi (BP); Njabulo and Bec (BHP); Noel (Rio); Nik (APA); James (ISO)	• Updated provided (see attached)	P.32
	I25	Moderate	Simple				-
I26		Moderate	Simple	David (HP)	Njabulo and Bec (BHP); Nik (APA)	• Updated provided (see attached)	P.34
I27		Moderate	Simple	Nik (APA)	David (HP); James (ISO); Njabulo and Bec (BHP); Noel (Rio)	Closed. Previously agreed proposal can be included in consultation paper.	-
I28		High	Substantive	David (HP)	Noel (Rio); James (ISO); Njabulo and Bec (BHP), Nik (APA)	• Updated provided (see attached)	P.36

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I29		High	Substantive (study likely)	James (ISO)	David (HP); Njabulo and Bec (BHP)	• Updated provided (see attached)	P.38
I30		High	Substantive	Shervin and Scott (Woodside)	David (HP); Noel (Rio); Njabulo and Bec (BHP), Nik (APA), James (ISO)	• Updated provided (see attached)	P.41
I31		Moderate	Simple	David (HP)	Njabulo and Bec (BHP)	• Updated provided (see attached)	P.42
I32	I32	Moderate	Substantive (study likely)	James (ISO)	Noel (Rio); David (HP); Njabulo and Bec (BHP), Nik (APA)	• Updated provided (see attached)	P.43
	I33	Moderate	Substantive (study likely)	James (ISO)			
I35		Moderate	Substantive	Njabulo (BHP)	Nik (APA)	• -	
I38		Moderate	Substantive	Njabulo (BHP)	Shervin and Scott (Woodside)	• -	-
I40		Low	Simple	David (HP)	Njabulo and Bec (BHP)	• Updated provided (see attached)	P.45
I41	I41	Low	Simple	James (ISO)	Noel (Rio); Njabulo and Bec (BHP), Nik (APA)	• Updated provided (see attached)	P.48
	I42	Low	Simple			• Updated provided (see attached)	P.49
I43		Low	Simple	James (ISO)	Njabulo and Bec (BHP)	• Updated provided (see attached)	P.54
I44		Low	Simple	Noel (Rio)	James (ISO); David (HP); Nik (APA); Njabulo and Bec (BHP)	• -	P.56
I45		Low	Simple	Noel (Rio)	James (ISO); Njabulo and Bec (BHP); Nik (APA)	• -	P.57

Issue 3

Note: Status update from the working group. Active discussion on some of these topics is ongoing. Recommendations may need to be adjusted once these conversations conclude.

As provided by Noel Michelson to EPWA by email (05 November 2024)

Issue I3 "Definition of Contingency Event"

Issues identified:

- PNR and HTR have different definitions of credible contingency event.
  - HTR refers to a credible contingency event as any type of fault that can occur (single phase to ground, three phase etc)
  - PNR refers to "Pre-contingent threat" as defining that is a credible event which can occur, that will cause a contingency event

- Different definitions with multiple components can result in differing interpretations.

- Review into sub-chapter 7.3 & 7.4 utilises the existing PNR definition.

Recommendation:

- Align PNR and HTR definitions of credible contingency events to have a common definition.

- (For consideration of PNR working group, consider better terminology to define what is credible, as the definition of what is credible is hidden within the definition of "Pre-contingency threat")

- A clear definition of what contingency events are, and what a credible contingency event is will assist with interpretation.

- AEMC offers a clear definition of credible and non-credible contingency events, recommend adopting definition in line with AEMC. https://www.aemc.gov.au/energy-system/electricity/electricity-system/security

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 the proposed regulations)*

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 where possible.
- Check the scope and application of the proposed regulations to network operators only or more broadly.

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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?

Commented [Lj1]: It would be useful to understand where this requirement came from.

Commented [Lj2]: Will GTs ride through these requirements?

Commented [DS3R2]: Included a review in scope item 5 below.

Commented [Lj4]: In the WEMR the requirement is amended to 0.25Hz over 500ms (i.e. 0.5Hz/s). However the WEM also contracts a ROCOF control service, there is no mechanism at present in the NWIS

Commented [DS5R4]: Included in review - scope item 5 below.

Commented [no6]: This is more to determine if it is needed or not, especially in the context of a low inertia high ROCOF future.

Commented [DS7R6]: Included in scope item 3 - relevance of ROCOF to islanding schemes.

- 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.

Commented [DS8]: Insert column - which scenarios are relevant and timeframe relevance

Commented [DS9R8]: On further review, scenarios A and B (short term and long term) are relevant for all study items, as we want to understand whether there are any immediate changes, but also a view on the future suitability of the PHTR for future scenarios.

Commented [no10]: I think the biggest challenge here will be defining the future states. Perhaps we need to consider if we model for current state only, plus approved projects, or future state with conceptual projects. This may trigger confidentiality provisions which may mean ISOCo need to manage this???

Commented [DS11R10]: Good one for discussion with the broader team and next stage of development of this scope. I would suspect we need to look at present state, and long term future state aligned to the PNR review scenarios.

Commented [Lj12]: It would be prob useful to validate that the NWIS model's dynamic characteristics are correct based on event data, if not already assessed.

Commented [DS13R12]: Agreed. I expect we'll need to use the best available models through ISO.

Commented [PV14]: Generators have obligation to comply with the requirements. How will the study proceed if system does not perform due to some generators not complying? In this instance it would seem inappropriate to adjust technical requirements to make the system perform.

Commented [DS15R14]: Added a comment at end of scope in relation to this.
Will need to deal with this on case by case basis if discovered. Doesn't remove the need for the study but will need to be carefully considered.

Commented [Lj16]: Agree that this one definitely needs a review, compliance with this clause in specific ...

Commented [no17]: I wonder if this has a grid forming/grid following context here? Do we need ...

Commented [PV18]: In principle, the same standard should apply to all technology types where possible. What is the driver to reducing the ROCOF ride through ...

Commented [DS19R18]: Agreed and good question - I suspect there may be concerns around plant capability but we can have a group discussion on this one.

Commented [PV20]: Outcomes of this study are highly dependent on assumptions of contracted SRESS and ...

Commented [DS21R20]: We have been asked to consider the adequacy of the PHTR in the future context so the study needs to consider future scenario ...

Commented [Lj22]: Support this.Would support a review of both UFLS and UFIS. It would also be good to assess if the system could operate without UFIS, to ...

Commented [DS23R22]: Added that scenario

Commented [PV24]: As above, how will the need to update this be determined? If some generators can't ...

Commented [DS25R24]: Will need to assess on case by case basis. Studies may need to adjust rate of response and see the system effect (assume ...

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.

Commented [PV26]: Subject to degree of generators' compliance with droop response requirements. Also impacted by UFLS settings which are likely to be reviewed simultaneously. This will need appropriate sequencing.

Commented [DS27R26]: Agreed.

Scenarios – Demand and Generation Capacity

A. Existing System Scenario (present date, based on existing system model from ISO, and with the inclusion of committed/approved projects)

   The existing system scenario would be used to inform potential short-term (1-5 year) changes to the PHTR.

B. Future System Scenario (future date – 2035, based on extension of existing system model, but with alignment with PNR workstream scenario 1B - prepared under the PNR workstream, in the report "Draft Scenario Outline and Modelling Assumptions" (17 May 2024).

		Level of integration		
		A (Current practices)	B (Partial integration)	C (Full integration)
Sectoral drivers	1 (CT)	1A	1B	1C
	2 (CT+)	2A	2B	2C

   The future system scenario would be used to inform potential medium-term (5-15 years) changes to the PHTR.

Load scenarios – consider a credible range of load levels as required, including but not limited to:

- Minimum load scenario in the NWIS model
- Maximum load scenario in the NWIS model

Dispatch scenarios – consider a credible range of dispatch scenarios as required, including but not limited to:

- Normal dispatch scenario, reflecting the balancing nominations implemented in the EBAS regime. These nominations reflect the contractual supply arrangements currently in place. Within each dispatch portfolio, most efficient generation was dispatched first.
- Further credible dispatch cases by considering select generating units out of service and dispatching the next most efficient machine.

- Potentially, further credible dispatch cases representing common abnormal system conditions such as maximum east generation dispatch scenario (large system flow from East to West) or maximum west generation dispatch scenario

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

Study Scope – Further Considerations

Note that any recommendations from the study should consider capabilities of plant to deliver on those recommendations.

Note that some of the studies could potentially pick up issues that indicate generator model non-compliance, rather than a deficiency in the PHTR, therefore adverse findings in the studies may not necessarily indicate a driver for change to the PHTR. Any recommendations should carefully consider this issue.

PHTR Issue 7 – NWIS Power System Strength

Issue #7 – Classification:

High Priority, Substantive, Governance & Technical

Issue #7 – Description:

"Consider requirements for NSPs to specify NWIS power system strength requirements and complete necessary assessments as renewable penetrations increases to ensure power system security."

"Grid-Following" Inverter Based Generation (IBG) are generally based upon current-controlled voltage source inverters that rely on an external voltage reference to follow, whereas synchronous machines and "Grid-Forming" IBG utilise an internal voltage reference. The requirement for an external voltage reference means the voltage waveform at the inverter terminals needs to be stable for reliable operation. The term system strength is typically used to provide indication of the voltage waveform stability for all system conditions including, steady state, during/following an electrical disturbance, sudden changes in load etc. The measure of system strength is typically the balanced three phase fault level.

Synchronous machines, with their low sub-transient and transient impedance, provide high initial fault levels and hence system strength. As synchronous machines are displaced by IBG, the system strength will decline. This will likely have an adverse impact on items including but not limited to electrical protection schemes, voltage stability and inverter control stability.

At present, there is no specific requirements for, or guidance on, NSP's determining minimum system strength requirements.

Without minimum system strength requirements and defining responsibility for providing system strength, it is credible as further IBG is connected, that system stability and protection scheme performance will be compromised.

It is noted that the, as part of the SWIS Power System Security and Reliability (PSSR) Standards Review, the PSSR Standards Working Group are addressing (Issue 8) the SWIS System Strength Framework. Refer https://www.wa.gov.au/system/files/2024-10/pssrswg_2024_10_10_combined_papers_0.pdf

Issue #7 – Solution Options:

1. Do Nothing
   Not considered acceptable as the growth of IBG displacing synchronous machines, without management of system strength is likely to result in power system instabilities and degradation of some electrical protection schemes.

2. Develop a framework for the management of system strength within the NWIS, leveraging the work undertaken by the PSSR Standards Working Group.

Issue #7 – Recommended Actions:

Option 2 is recommended noting that considerable effort has been applied to this topic for the SWIS and much of this work will be applicable to the NWIS.

1. PHTR Issue 8 – holistic review of treatment of BESS and inverter based generation (IBR)

1.2 Issue 8 - Classification

High, Substantive, Technical

1.3 Issue 8 - Description

The HTR provides detailed technical performance standards for synchronous generating systems, predominantly in clause 3.3. It also differentiates between synchronous and non-synchronous generating systems in several places, for example:

- HTR cl. 3.3.3.3(f) "Post-fault reactive power of a power station with non-synchronous generating units".
- HTR cl. 3.3.3.3(h) "Continuous uninterrupted operation".
- Subclauses (c), (e) and (g) of HTR cl. 3.3.4.5 "Voltage control system".
- HTR cl. 3.4.5 "Requirements of clause 3.3 applicable to small power stations".
- HTR cl. 4.1.3 "Tests to demonstrate compliance with connection requirements for generators".

Storage works do not fit easily into the HTR. Clause 3.7 allows the NSP and the ISO to treat storage works as follows:

- HTR cl. 3.7(b)(1) - With respect to its injections, as a generating unit.
- HTR cl. 3.7(b)(2) – with respect to its withdrawals, as consumer equipment.

Requirements for storage works with respect to its withdrawals are covered in Issue 12 and are not discussed further here.

HTR cl. 3.7(b) works relatively well for BESS in respect of its injections, by allowing the NSP and ISO to apply HTR cl. 3.3 to such facilities. However, there remain several areas for improvement. For example:

- HTR cl. 3.3.4.4(e) specifies frequency control requirements for dispatchable synchronous generating systems, but not for dispatchable non-synchronous generating systems such as BESS.
- HTR cl. 3.3.4.4(f) specifies frequency control response rates for generating units with an apparent focus on traditional synchronous generation. The response rates specified (e.g. 90% within 6 seconds) are significantly slower than the response rates available from inverter-based storage works such as BESS, which can typically achieve 90% of the expected response in 2 seconds or less.

It is recognised that a process is underway in Western Australia's Wholesale Electricity Market (WEM) to define technical performance standards of storage devices, including BESS[1].

1.1 Issue 8 – Solution Options

Option 1 – Do nothing.

- Key areas of technical performance standards of IBR storage works will continue to be ambiguous or suboptimal.

Option 2 – Amend HTR cl. 3.3 to address specific areas where the applicable technical standard is not defined for dispatchable, non-synchronous generation.

- HTR cl. 3.7(b) provides the NSP and ISO with adequate powers to define technical performance standards for BESS with respect to injections, by leveraging the requirements laid out in cl. 3.3.
- Fixing the gaps in cl. 3.3 will allow cl. 3.7(b) to continue to operate appropriately until broader amendments to the HTR for storage facilities can be scoped and implemented.

Option 3 – Rewrite HTR cl. 3.7 to include comprehensive requirements for inverter-based storage facilities with similar scope to HTR cl. 3.3.

- This would give the highest level of clarity and certainty to industry about technical performance standards of BESS.
- As this would be a large and complex piece of work, it is recommended to allow the completion of the standards review process in the WEM to inform this approach.

1.2 Issue 8 – Recommended Actions

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

- A staged approach is considered appropriate, with Option 2 feasibly implemented in the first tranche of HTR updates. This will yield the desired benefits in the short to medium term.
- Option 3 can follow the implementation of Option 2, while taking the learnings from the NWIS operation under changes introduced by Option 2 and leveraging the review process for the WEM technical standards once completed.

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[11] See slide 16 of power-system-and-security-standards-working-group-papers.pdf

2. PHTR Issue 9 – Definition of grid-forming vs grid-following, with regard to different technical performance/capabilities of the technology types

1.3 Issue 9 - Classification

High, Substantive, Technical

1.4 Issue 9 - Description

While technology agnostic, the HTR is written with a bias towards synchronous generating facilities and traditional current source converter technology, a natural outcome given the prevailing technologies available at the time. Rapid advancements and reductions in cost of voltage source converter technology are delivering a new class of technology that can provide many of the benefits of synchronous generation, but using non-synchronous technology. This technology is frequently referred to as "grid-forming", in that the inverters are able to regulate their voltage waveforms from an internal voltage source, independent of the grid voltage. This allows the inverters to form a "grid" without external generation support.

In contrast, current source inverters are "grid-following" inverters that rely on an external voltage to provide the reference voltage waveform for the modulation of the inverter's output voltage. These inverters cannot form a grid independent of an external frequency-setting power source.

It is becoming increasingly common to develop BESS and solar PV generating facilities using voltage source conversion technology. There are two common applications of this:

- BESS facilities with voltage source inverters coupled to the system's AC bus; or
- Battery units and solar PV units coupled to a common DC bus behind a voltage source inverter.

In both cases the injections into the system are through voltage source inverters.

These inverters are capable of several functions that emulate the characteristics of synchronous generation that benefit the system:

- Synthetic inertia that assists to slow down the rate of change of frequency during frequency disturbances.
- Frequency regulation support.
- Higher fault current contributions than current source inverters, assisting the operability of current based protection schemes.
- Higher tolerance for low system strength.

The benefits described above are not contemplated in the HTR as these were natural characteristics of synchronous generation that dominated the system at the time of publication. These benefits are expected to become increasingly important to system security and operability as synchronous generation is displaced by non-synchronous, inverter-based generation sources. There are jurisdictions in Australia and around the world where system services markets have been established for some of these characteristics to manage this transition away from wide-spread synchronous generation.

In the Pilbara there is a need, at minimum, to define these characteristics in the HTR, to help inform the specifications of new facilities being contemplated by existing or prospective market participants. As the system continues to shed natural sources of these characteristics, there will be a need to describe minimum performance requirements, both to ensure secure and predictable system performance, and as a qualifier for participation in various essential system services markets or network support contracts.

1.5 Issue 9 - Solution Options

Option 1 – Do nothing.

- BESS systems, and possibly wind and solar PV generating systems, with voltage source inverters will continue to be built out but with disparate capabilities in grid-forming characteristics.
- The coordination of finely tuned controllers that implement grid-forming capabilities will become increasingly challenging and burdensome, both on NSPs and on Access Seekers.
- The proliferation of varying performance standards for grid forming technology will complicate the development and implementation of markets or network support contracts for synthetic inertia, frequency regulation and fault current support.

Option 2 – Provide definitions in the HTR for "grid forming", "grid-following" and for the unique characteristics of grid-forming technology such as "synthetic inertia".

- Consult with Pilbara stakeholders that have or are developing facilities utilising voltage source converter technology in the Pilbara (NWIS connected or otherwise).
- Consult with Original Equipment Manufacturers (OEMs) of voltage source conversion generation and storage technology.
- Leverage the work done in other jurisdictions on these topics, both within Australia and internationally.
- This approach signals to industry how the technology will be understood by NSPs and the ISO in the grid connection process. It also builds the foundation for market participation criteria of essential system services markets that may be developed for the characteristics of this technology. Project developers can use this to specify the functionality and performance standards in their procurement processes.

Option 3 – Develop comprehensive technical requirements for grid-forming generation and storage facilities.

- This would give the highest level of clarity and certainty to industry about technical performance requirements of grid-forming and grid-following technology.
- There is limited operational experience, both in Australia and globally, with the use of this technology in large utility grids, particularly in the application of synthetic inertia and fault current contribution. The technology is, in some ways, still on the road to maturity. Techniques and capabilities of inverter-based technology is rapidly changing. Developing comprehensive technical requirements may be premature, and the resultant HTR may be out of date before it is implemented.

1.6 Issue 9 – Recommended Actions

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

- It may be prudent and efficient to await the completion of the review process being undertaken for the instruments in the Wholesale Electricity Market[2], which is likely to define the concepts of grid-forming and grid-following technology and may also result in technical requirements for the characteristics discussed in this paper.

[2] Power System Security and Reliability Standards Review

3. PHTR Issue 12 –Requirements for Storage Devices to provide network support services when in load/charging mode

1.7 Issue 12 - Classification

High, Substantive, Technical

1.8 Issue 12 - Description

The HTR clause 3.7 allows the NSP and ISO to treat the BESS, for the purposes of identifying technical performance standards, as a generator in respect of its injections, and as a load in respect of its withdrawals. There are some cases where it is desirable to apply the performance standards of a generator to the BESS when in "idle" mode (zero injections/withdrawals) or in charging mode.

Examples of generator performance standards under HTR cl. 3.3 that are desirable to apply to BESS in idle or charging mode include (but may not be limited to):

- HTR cl. 3.3.3.1 "Reactive power capability".
- Various subclauses of HTR cl. 3.3.3.3 "Generating unit response to disturbances in the power system".
- HTR cl. 3.3.3.6 "Safe shutdown without external electricity supply".
- HTR cl. 3.3.3.7 "Restart following restoration of external electricity supply".
- HTR cl. 3.3.3.8 "Protection of generating units from power system disturbances".
- Various subclauses of HTR cl. 3.3.4 "Monitoring and control requirements".
- HTR cl. 3.3.9 "Computer model".

It is recognised that a process is underway in Western Australia's Wholesale Electricity Market (WEM) to define technical performance standards of storage devices, including BESS[3].

1.9 Issue 12 - Solution Options

Option 1 – Do nothing.

- BESS will continue to be permitted to disconnect from the system while idle or in charging mode, for narrower voltage and frequency ride-through requirements, compared to the generating mode.
- Networks will not be able to benefit from BESS' unique capability to provide reactive power / voltage support while in charging mode.

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[33] See slide 16 of power-system-and-security-standards-working-group-papers.pdf

- The system will not be able to benefit from a BESS’ frequency droop response while in charging mode.
- Industry continues to lack clarity and certainty of the technical performance standards for BESS prior to commencing the Access and Connection process.

Option 2 – Amend HTR cl. 3.7 to allow NSPs and the ISO to treat storage works, in respect of its injections, as a generating unit for select clauses under HTR cl. 3.3.

- Selected clauses from HTR cl. 3.3 are to be listed in the amended clause.
- Selected clauses must be limited to those clauses that
    - allow the networks or the system to benefit from the unique capabilities of the inverter-based storage works;
    - ensure BESS can be depended on to provide limited generation support services during system disturbances while in charging mode; and
    - take advantage of BESS’ inherent capabilities to minimise the impact of BESS facilities in charging mode, on the resilience of the network or system to power system disturbances.

Option 3 – Rewrite HTR cl. 3.7 to include comprehensive requirements for inverter-based storage facilities with similar scope to HTR cl. 3.3, including requirements when in charging (withdrawal) mode.

- This would give the highest level of clarity and certainty to industry about technical performance requirements of BESS.
- As this would be a large and complex piece of work, it is recommended to allow the completion of the standards review process in the WEM to inform this approach.

1.10 Issue 12 – Recommended Actions

Option 2 is recommended on the merits described above with consideration to the following:

- A staged approach may be appropriate, with Option 2 feasibly implemented in the first tranche of HTR updates. This will yield the desired benefits in the short to medium term.
- Option 3 can follow the implementation of Option 2, while taking the learnings from the NWIS operation under changes introduced by Option 2 and leveraging the completion of the review process for the WEM technical standards.

1. PHTR Issue 13.A – Definition and use of 'energisation' vs 'commercial operations' is inconsistent throughout the HTR and PNR. Clarity is required about the process and what actions are required from each party at which stage.

1.1 Issue 13.A - Classification

High, Substantive, Governance & Technical

1.2 Issue 13.A - Description

Definitions and use

HTR Section 1.5 Interpretation table defines 'energisation' as "the act or process of operating switching equipment or starting up generating unit, which results in there being a non-zero voltage beyond a connection point or part of the transmission system or the distribution system."

The term 'energisation' is not used in the HTR.

HTR clause 4.1.3 (b) (1) (bold added) "A generator must provide evidence to the NSP that each of its generating units complies with the technical requirements of clause 3.3 or 3.4, as applicable, and the relevant access contract, prior to commencing **commercial operation**. In addition, each generator must cooperate with the NSP in carrying out power system tests prior to **commercial operation** in order verify the performance of each generating unit, and provide information and data necessary for computer model validation. The test requirements for synchronous generating units and for non-synchronous generating units are to be specified under Attachment 11."

HTR clause 4.1.3 (b)(3) (bold added) "These compliance tests must only be performed after the machines have been tested and certified by a Chartered Professional Engineer with National Professional Engineers' Register standing qualified in a relevant discipline, unless otherwise agreed, and after the machine's turbine controls, AVR, excitation limiters, power system stabiliser, and associated protection functions have been calibrated and tuned for **commercial operation** to ensure stable operation both on-line and off-line. All final settings of the AVR, PSS and excitation limiters must be indicated on control transfer block diagrams and made available to the NSP before the tests."

PNR Rule 270 (4) "If the ISO gives the Registered NSP a notice under rule 270(2)(a), the NSP may energise, or approve the energisation of, the New Connection."

The terms 'energisation and commercial operations' is used in the Interim Access and Connection Procedure.

The PNR does not use the term 'commercial operation'.

Analysis:

- HTR uses the term “commercial operation” in the context of specifying testing and model validation activities by NSP and connection applicants for new connections, before allowing the facility to commence operations.
- PNR uses the term “energisation” in the context of the ISO granting approval to the NSP to allow the NSP to make live, or for the NSP to allow the proponent to make live, a new connection. This approval is treated in PNR R269 and R270 as approval for commercial operations.
- This approval is subject to the NSP notifying the ISO, and the ISO agreeing, that it has carried out its obligations under the PNR and HTR with respect to the new connection (PNR 269). This includes the “approval and Connection process for a New Connection have been complied with” (PNR 269(b)). HTR clause 4.1.3 would presumably fall within the scope of this “connection process” for generating facilities.
- The outcome of the above is that the PNR does not allow energisation of a new generating facility until the facility has provided evidence that it complies with the HTR’s technical requirements (which at least requires power system studies and possibly grid-connected testing), and has completed testing to verify its performance against these requirements (requiring grid-connected testing).

Summary:

- The PNR is internally contradictory with respect to the process for energisation of new generating facilities. To authorise energisation, it mandates the NSP to certify that it has conducted activities that require energisation.
- Furthermore, the PNR uses the term “energise” to simultaneously mean
    - making the connection point have a non-zero voltage, and
    - commencement of commercial operation.
- In doing so, the PNR creates a scenario in which an Access Seeker’s compliance with HTR clause 4.1.3 is impossible without causing an NSP to breach compliance with PNR rule 269 and 270.

1.3 Issue 13.A – Solution Options

Option 1 – Do nothing.

- The PNR continues to be internally contradictory with respect to the process around the ISO’s certification for, and the NSP’s approval of, energisation of new generation connections.
- The PNR and HTR continue to create situations that force either an Access Seeker or the NSP, to breach compliance with either the HTR or PNR, respectively.

Option 2 – Amend the PNR and HTR as follows:

- Add new definition to PNR and HTR for “commercial operation”.
- Move the HTR definition of “energisation” to the PNR, amend definition in the HTR to point to PNR definition.
- Substitute the current PNR references to “energisation” with “commercial operation”.
- Add new PNR rule dealing with process to obtain authorisation for energisation for the purposes of testing and commissioning.

  - This new rule must mandate a detailed process for energisation to be included in the ACP.
  - The rule must mandate specific features of this process to grant the necessary head of powers, for example:
    - ISO to certify and NSP to approve initial energisation, similar to current Rule 269/270
    - need to have regard to GEIP
    - types/limits on conditions of approvals
  - The rule should include an option for the NSP with ISO to grant an interim approval to operate for the period between completion of testing and before approval for commercial operations under the amended Rule 270(4). This approval must be at ISO discretion having regard to test results, GEIP, system security objectives, be subject to conditions/constraints etc.
- With the above changes, the existing use of "commercial operation" in the HTR is appropriate, requiring no other changes to HTR.

1.4 Issue 13.A – Recommended Actions

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

- Given the recommended changes, this issue may appear to be better placed in the PNR workstream. However, the issue is of a technical nature and interacts heavily with the HTR. It is therefore proposed to retain this issue in the HTR workstream.

2. PHTR Issue 13.B – Inclusion of data to be submitted with connection applications (See Horizon Power Tech Rules Sections 3.3.2, 3.4.3, 3.6.5, and Attachments 3-10).

2.1 Issue 13.B - Classification

High, Substantive, Governance & Technical

2.2 Issue 13.B - Description

This issue deals with the question whether or not the information requirements for connection applications should be provided in the HTR.

Case against:

- PNR Subchapter 9.2 defines the roles of the ISO and the NSP with respect to connection applications.
- PNR 269 makes the Registered NSP responsible for connection standards.
- PNR 268 gives the ISO the function of supervising connection standards, assisting Access Seekers and Registered NSPs with preparation and processing of Access Applications and negotiating access contracts, providing modelling services for the above.
- ISO's function is worked out in the ACP as one of conducting due diligence on Access Seeker's and NSP's work and conclusions and giving guidance on matters to consider relating to system security and reliability.
- NSPs are the custodian of network connections and set out the process and information requirements in their own access policies, procedures and guidelines.
- NSPs interface with the Access Seeker while the ISO predominantly interfaces with the NSP.
- NSPs may have different processes and templates for connection applications, which may involve different information requirements.
- Information for access applications is largely a process matter which may change as technologies, modelling methodologies, templates and project requirements change.
- ISO understands the practise of including information requirements in Technical Rules attachments arose from the SWIS Technical Rules owned by Western Power who is the sole NSP on the South-West Interconnected System. This practise was carried across to the Horizon Power and Rio Tinto Technical Rules, likely as a matter of convenience.
- In the NWIS there are currently two covered NSPs and one non-covered NSP. Each NSP is required to act in accordance with GEIP and to ensure the technical user requirements of the HTR are met.
- The case can be made that the information required for connection applications should be detailed in each NSP's procedures/guidelines for access to their respective networks, rather than in the HTR. This allows the information requirements to be tailored to each NSP's access process.

Case for:

- Access Seekers are required to submit power system models of their facilities that are ultimately incorporated into the ISO's NWIS model. This calls naturally for a level of standardisation in the content and format of technical information underpinning these models.
- Much of the information required for power system modelling is currently described in the ISO's Power System Modelling Procedure (PSMP), however, this is currently specified at a high level only. It does not define the content, format and units of technical data.
- As a general rule, it is desirable to have less, rather than more, documents which access seekers and NSPs have to consider during the connection process.
- Should the HTR not specify the information requirements, the ISO may need to introduce some specification in the PSMP for the information required for power system modelling and due diligence reviews under the ACP. This would duplicate, and possibly contradict, the efforts of NSPs.

2.3 Issue 13.B - Solution Options

Option 1 – Do nothing.

- NSPs will need to continue to include requirements in their respective access policies/guidelines/technical rules.
- The ISO may need to introduce some specification in the PSMP for the information required for power system modelling and due diligence reviews under the ACP. This would duplicate, and possibly contradict, the efforts of NSPs.

Option 2 – Include high-level requirements for submission of technical information in HTR attachment.

- Schedules to be drawn from Horizon Power and Rio Tinto technical rules, with amendments to capture specific requirements for emerging technologies (e.g. grid-forming inverters, synchronous condensers).
- Schedules to include data categorisation system similar to the system detailed in Attachment 3 of the Horizon Power Technical Rules.
- As an added benefit to this update to the HTR, it is recommended to update the Access and Connection Procedure to indicate the data categories that will typically apply to each stage of the connection process, with the caveat that the actual data requirements for each stage will be confirmed by the NSP[1].
- As an example, and using Attachment 3 of the HP Technical Rules:
  - Stage 1 Feasibility – Standard Planning Data (S);
  - Stage 2 Application Assessment – Detailed Planning Data (D);
  - Stage 3 Connection Assessment – Registered Data pre-connection (R1) and post-connection (R2).

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[1] The point is not to replace the requirements in the NSP's connection process, but to give guidance on how the information generally maps to the ISO's connection process, subject to the NSP's requirements.

2.4 Issue 13.B – Recommended Actions

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

- As a general rule, it is desirable to have less, rather than more, documents which Access Seekers and NSPs have to consider during the connection process.
- Should the HTR not specify the information requirements, the ISO may need to introduce some specification in the PSMP for the information required for power system modelling and due diligence reviews under the ACP. This would duplicate, and possibly contradict, the effort of NSPs.

3. PHTR Issue 37 – Inclusion of testing requirements for new generation connections

3.1 Issue 37 - Classification

Moderate, Substantive, Technical

3.2 Issue 37 - Description

This issue deals with the question whether or not the required tests for new generation connections should be provided in the HTR, and differentiation in tests for dispatchable and non-dispatchable facilities.

The stability of a power system depends to a large extend on the technical performance of its generating facilities. Generator performance can be broken down into two main areas:

1. coordination of generator controllers, both with respect to interactions between controllers of different generating facilities (and generating units within a facility), and to controllers' responses to power system disturbances (including disturbances within the facility); and
2. capability of the generating equipment, the energy producing equipment, to deliver the outcomes coordinated by the controllers.

For any new generator connection, the above performance matters are assessed using two instruments:

1. Power system modelling and studies; and
2. Generator testing.

These instruments operate in parallel and converge on one another as the project moves through the connection process. This is generalised and depicted as follows.

Connection process stage	Power system studies	Generator testing
Project Feasibility	Generic models used to assess steady-state impact (voltage and thermal loading) on the power system.	Proponent seeks budget pricing from suppliers with demonstrated technical performance suitable for the specific market.
Connection Application	Dynamic studies with tender submission data to assess dynamic impacts on the power system and plant capability to comply with technical rules.	Proponent seeks type test certifications and specifies factory and site acceptance tests in procurement contracts.

Connection process stage	Power system studies	Generator testing
Connection Assessment	Pre-connection - dynamic studies with detailed design data pre-connection. Post-connection - dynamic studies with model validation test data post-connection.	Proponent and supplier conduct site acceptance tests, performance guarantee tests, and model validation testing, both on and off-grid.

Generator testing is therefore an integral component of system security that is heavily linked to the power system studies that underpin the NSP and ISO's assessment of the new connection. Most notably, model validation testing towards the end of the process requires close alignment between assessments conducted using the model and tests conducted on the equipment.

The approach to power system studies for grid connections has over time been standardised within the industry and across jurisdictions. A natural consequence of the relationship described above and the standardisation of power system studies for grid connections, is that the generator tests have also been standardised. This standardisation has the following benefits:

- Provides supplementary information to project developers and suppliers for the technical performance criteria that will be applied to a new connection.
- Enables project developers, their suppliers and consultants to develop more reliable scopes, costs and schedules for the grid connection process.
- Enables NSPs and system operators to develop streamlined connection processes and more efficiently develop internal resources to conduct technical due diligence and assessments.

The Pilbara would likewise benefit from a standardised set of generator tests. This has already been implemented on a network basis, with both Rio Tinto and Horizon Power in their technical rules specifying standard tests for new connections, as well as special tests that may be warranted in certain circumstances.

3.3 Issue 37 - Solution Options

Option 1 – Do nothing.

- NSPs will need to continue to include and maintain requirements in their respective access policies/guidelines/technical rules.
- NSPs and Access Seekers would lack clarity on the ISO's expectations for model validation tests. This would likely require the ISO to eventually publish guidance on the expected generator tests for model validation or to include these in the Access and Connection Procedure.

Option 2 – Include generator testing requirements in an HTR attachment.

- Include minimum standard requirements in a HTR attachment.
- Include special tests that may be required by the NSP in consultation with the ISO.

- Draw primarily from Horizon Power Technical Rules, obtain input from Rio Tinto Technical Rules for any additional tests.
- Remove standard tests specific to microgrids, move these to Special Tests if appropriate.
- Review other jurisdictions' technical rules for tests specific to BESS, IBR and non-dispatchable generation, and include these if appropriate for the Pilbara (and with amendments as required) considering current and ESS markets (i.e. contingency reserve (SRESS) and regulation reserve (FCESS)).
- NSPs to retain the right to require additional tests that are not listed in the HTR.

3.4 Issue 37 – Recommended Actions

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

- As a general rule, it is desirable to have less, rather than more, documents which Access Seekers and NSPs have to consider during the connection process.
- Should the HTR not specify the testing requirements, NSPs and Access Seekers would lack clarity on the ISO's expectations for model validation tests. This would likely require the ISO to eventually publish guidance on the expected generator tests for model validation or to include these in the Access and Connection Procedure. It would be better to communicate the expectations within the HTR as the primary source of technical compliance standards.

PHTR Issue 22 – Disturbance Monitoring and Synchrophasors

Issue #22 – Classification:

Moderate priority, Simple, Technical

Issue #22 – Description:

With decarbonisation goals across the state, newer generation sources are primarily inverter-based resources (IBR) which present challenges in managing dynamic stability. In the USA, visibility of dynamic stability has been deemed so critical that the US Department of Energy founded the North American Synchrophasor Initiative (NASPI). In Grid India, new generator connections have a mandatory requirement to ensure synchrophasors are measured in the transmission system.

Implementation of synchrophasors are simple: select an accurate time source (atomic clock, GPS time signal, or similar), connect it to a protection intelligent electronic device (IED) which has synchrophasor capabilities (making it a Phasor Measurement Unit, or PMU), connect it to a capable communications system and aggregate the data into a Phasor Data Concentrator (PDC). This provides operational visibility of dynamic and small signal stability of the power system, known as a Wide Area Measurement System (WAMS). Quantities to measure may include frequency, rate of change of frequency, voltage signals (observe modes) and additional benefits with power quality monitoring.

Additional protection and control layers can be added to this system, resulting in a Wide Area Measurement, Protection and Control System (WAMPAC). This is an enabler of high penetration of renewables with confidence in maintaining system security and aligns with strategies to decarbonise the NWIS.

New IBR connections will connect with IEDs that are compliant to IEC 60255 and already have synchrophasor capability. New facilities' protection schemes are generally expected to be connected as unit protection, which will rely on end-to-end fast communications, typically provided by reliable carriers such as an optical ground wire (OPGW).

Issue #22 – Solution Options:

1. Adopt the rule amendment and require synchrophasors to be installed at major transmission nodes in the Pilbara. This should include a GPS clock to allow synced disturbance monitoring; OR
2. Do nothing (leave as is).

By requiring synchrophasors within the Pilbara Harmonised Technical Rules:

- Proponents will have awareness that synchrophasor integration needs to be considered as part of their facility design;
- The ISO and NSPs will have improved confidence and capability to integrate large scale renewables safely, reliably, and securely; and
- System performance can be monitored both in real time and through the data historian, enabling accurate investigations, compliance monitoring and improvements to the Pilbara Grid power system model.

Issue #22 – Recommended Actions:

- Update PHTR Section 3.3.4.1 (d)(3)(a) to include synchrophasor as an acceptable measured value as determined by the relevant NSP. Suggested wording below.
- Make remote monitoring compulsory across all major transmission nodes, and minor nodes as determined by the relevant NSP.
- Develop a procedure to define data formats, data exchange protocols and allow ISO access to synchrophasor data.
- Check proposed wording for WEM/SWIS to ensure alignment where possible.

Due to the expected low cost of integration relative to the benefits, it is recommended that the proposal above be accepted. The following amendment to the Harmonised Technical Rules is proposed below:

"(3) Measured Values

(A) transmission system:

(i) …

(xi) synchrophasors, as advised by the Network Service Provider."

Term	Description
Synchrophasor	A synchronised phasor, being a measurand synchronised to an accurate time source, aligned with the definition provided in IEC 60255-118-1 (2018): "Phasor representing the fundamental of an AC signal whose magnitude is the RMS value of the fundamental amplitude and angle is the difference between the signal fundamental angle and the phase angle of a cosine at the nominal signal frequency that is synchronised to Universal Time Coordinate (UTC) time"

PHTR Issue 23 – Reactive Power Capability Figure 3.3

Issue #23 – Classification:

Moderate Priority, Simple, Technical

Issue #23 – Description:

Figure 3.3 in the PHTR shows reactive capability for inverter coupled generating units, but only shows positive active power as shown in the following diagram:

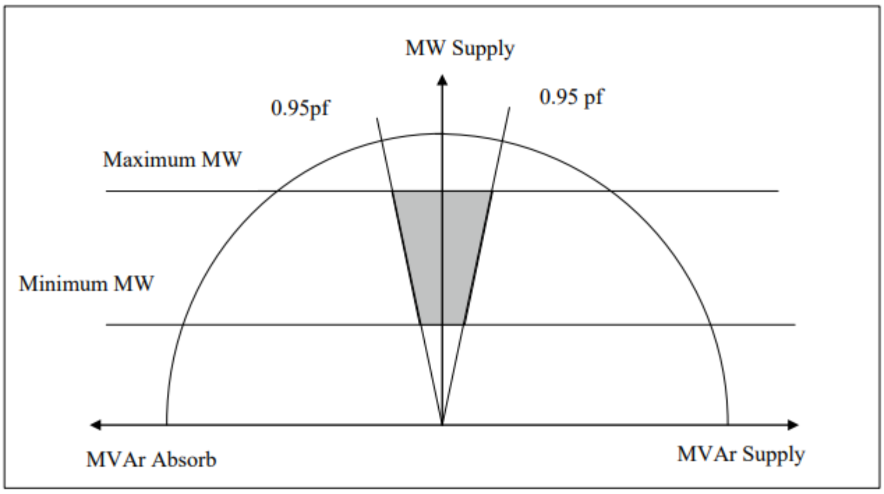

Figure 3.3 – Inverter coupled generating unit or converter coupled generating unit. Minimum reactive capability requirements at connection point shown shaded

The diagram neglects to cater fully for battery connected units which are capable of absorbing real power.

Issue #23 – Solution Options:

1. Update plot to show -ve MW, and add commentary to show that -ve MW is applicable for battery connected units. *(Recommended)*
2. Provide a separate plot and description for battery connected units.

   (Not recommended)
3. Leave as is *(Not recommended)*

Issue #23 – Recommended Actions:

- Update PHTR Section 3.3.3.1(c)(4) and figure 3.3 to cater for battery energy storage units.
- Consider outcomes of PHTR review issue #8 (energy storage and inverter based generation) and ensure consistency with these outcomes.

PHTR Issue 24 – Treatment of Ambient Temperatures

Issue #24 – Classification:

Moderate Priority, Simple, Technical

Issue #24 – Description:

This paper seeks to look at options to bring some clarify in the treatment of ambient temperatures in the Pilbara Harmonised Technical Rules (PHTR). Temperature dependency is a critical factor in the Pilbara that is not adequately addressed in the PHTR.

This paper looks at the following issues in relation to ambient temperatures:

- Clarify how ambient temperatures are determined in the context of Section 3.3.3.1 – Reactive Power Requirements. Presently the PHTR refers to the 'Figure below' which doesn't exist. Note this has implications for Section 3.3.3.3 (b).
- Clarify distinction of using 'nameplate' vs a derated capacity when determining which set of generator compliance rules should apply. It is not clear in the PHTR whether the ratings for different categories of requirements (eg 10MW, 1000kVA) refer to nameplate or derated values. Text refers to the 'combined rating' rather than Nameplate or derated values.

It is also noteworthy that the higher temperatures in the Pilbara will affect the generator's maximum real power output (or the maximum output that can be expected). Reactive power related requirements are linked to temperature, whereas historical versions of the rules including the current PHTR have not linked active power to temperature. Whilst there are no specific technical requirements in the PHTR (other than class definitions) it may be worth considering whether this issue should be resolved in the broader PNR/PHTR framework to allow the network operator to have a more realistic understanding of what the generation is able to and expected to achieve. e.g. should we be defining a 'derated' active power rating in the PNR or PHTR?

In the WEM, wind farms have been identified to struggle to meet the reactive power capability requirements at 40 degrees (for example A12.2.3.2). However, WEM Rules may be more realistic where consideration of temperature is concerned. Active power capability might need to be de-rated for wind and solar farms above certain temperatures.

Issue #24 – Solution Options:

1. Update PHTR Clause 3.3.3.1 (Reactive Power) to provide clarity on ambient temperatures to be used, using a method similar to WEM (AEMO guideline[1] - ambient temperature determined by NSP on 1% probability of exceedance).
   (Recommended)
2. Update PHTR Clause 3.3.3.1 (Reactive Power) to provide clarity on ambient temperatures to be used, using a map with designated ambient temperatures.
   (Not recommended, too static, upfront effort required, and variable data sets may not be comprehensive)

[1] https://aemo.com.au/-/media/files/electricity/wem/participant_information/2023/maximum-temperature-for-transmission-connected-generating-system/aemo-guideline---maximum-temperature-for-transmission-connected-generating-systems---v10---external.pdf?la=en

3. Cover in a new procedure detailing ambient temperature requirements and calculations. *(Not recommended, significant additional documentation for little gain)*
4. Leave as is *(Not recommended, due to the inconsistencies identified above)*

Issue #24 – Recommended Actions:

- Update Clause 3.3.3.1 (Reactive Power) – Update Note – remove reference to map and update to 1% POE in Hotter Months to be determined by NSP, consistent with WEM (AEMO guideline[2] or 50degC if not available).
- Update Clause 3.3.3.3(b) (immunity to frequency excursions, full operation) – Update Note 2 as above.
- Update Table 3.1, and introductory remarks in sections 3.3,3.4,3.5 to state that for the purposes of generator classes and technical requirements the 'Nameplate' capacity as defined in the PHTR shall be used.
- Conduct a general review of the PHTR in relation to references to active power ratings of plant (eg Sections 3.3.3.1(c), 3.3.3.1(h)) for consistency of terminology – eg registered active power rating, nameplate rating, full output etc.
- Consider whether there is a broader requirement in the PNR/PHTR framework for improved definition of ambient temperatures in relation to maximum expected active power output capability of generators. Consider whether there are any changes required to modelling guidelines to provide clarity in the treatment of ambient temperature impacts on plant ratings and capability.

  The implementation of the above recommendations should take into consideration the construction of plant in alignment with the "…efficient operation and use of…" aspect of the Pilbara Electricity Objective, and in particular with reference to active power not limit the ability to maximise the output of generation at temperatures lower than the maximum ambient temperature (generators can typically produce more at lower temperatures).

Commented [DS1]: Also modelling implications

[2] https://aemo.com.au/-/media/files/electricity/wem/participant_information/2023/maximum-temperature-for-transmission-connected-generating-system/aemo-guideline---maximum-temperature-for-transmission-connected-generating-systems---v10---external.pdf?la=en

PHTR Issue 26 – Monitoring and control requirements

Issue #26 – Classification:

Moderate Priority, Simple, Technical

Issue #26 – Description:

The Pilbara Harmonised Technical Rules (PHTR) approach to Requirements for Monitoring and Control of Equipment (RME/RCE), as outlined in Section 3.3.4, involves a general methodology without a mandatory set of requirements, relying instead on consultations between Network Service Providers (NSP), controllers, and customers to negotiate the specifics. Additional monitoring and control requirements for small power stations are specified in Section 3.4.9.

The RME/RCE framework is primarily based on control technologies for traditional synchronous machines and does not adequately address inverter-based generation technologies. Additionally, it fails to capture the necessary data and control points required for scenarios 1B/2A as part of the Pilbara Networks Rules (PNR) modelling.

With the rise of Distributed Energy Resources (DER) and their impact on system security, the current RME/RCE provisions in the PHTR are insufficient for the monitoring and control of DER.

Issue #26 – Solution Options:

1. Update to require mandatory monitoring and control of DER, and undertake a general review to ensure alignment with proposed scenarios 1B/2A of the PNR review *(Recommended)*
2. Update to require mandatory monitoring and control of DER only *(Not Recommended as a review of the existing RME/RCE requirements is required to provide sufficient data and controllability under scenarios 1B/2A as referred to in the PNR review)*
3. Leave as is *(Not a suitable option – inconsistent with review objectives, and not compatible with ESMR)*

Issue #26 – Recommended Actions:

- Update PHTR Section 3.5 to require mandatory monitoring and control capability of DER (embedded generators connected to the low voltage network via inverters up to 1000kVA). The intent being DER must be controllable by the NSP, with procedures and protocols for calling on that control able to be worked out at a later date in consultation with NSPs and the ISO.
- Undertake a general review of PHTR Section 3.3.4 to consider RME/RCE requirements of proposed scenarios of 1B/2A of the PNR review, and ensure controllability of embedded DER.
- Undertake a general review of PHTR Section 3.4.9 to consider RME/RCE requirements of proposed scenarios of 1B/2A of the PNR review, and ensure controllability of embedded DER.

Commented [DS1]: Need wordsmithing - all DER to be configured and controllable by NSP. But details of how and when control happens to be worked out later. Intent: All NSPs must have the ability to at least enact ‘backstop’ style control when instructed by ISO.

- Develop a monitoring and control procedure from the ISO that defines procedures and protocols for calling the control of DER and update PHTR Sections 3.3.4, 3.4.9 and 3.5 to refer to this procedure.
- Check RME/RCE proposed wording for WEM/SWIS to ensure alignment where possible.
- Check RME/RCE procedure from NEM/SWIS to ensure alignment where possible.

PHTR Issue 28 – Review of Fault Level Management

Issue #28 – Classification:

High Priority, Simple, Technical

Issue #28 – Description:

This paper outlines a high-level review of fault level requirements and fault level management in the Pilbara Harmonised Technical Rules (PHTR) considering:

- minimum fault rating requirements for Transmission plant at significant network nodes; and

- potential requirements for limitations on maximum fault levels on the system and guidance on the calculation of fault levels.

The purpose of this is to aid in coordination of fault level management across various NSPs on the Pilbara Grid, and ultimately to ensure fault levels on the system do not exceed fault withstand capability of plant on the system.

Note this paper does not address matters of System Strength.

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 – 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.

Commented [no1]: Perhaps consider splitting this out into transmission/bulk supply substations, tie lines, generation connected substations, distribution. Each application will have quite different fault level requirements.

Commented [DS2R1]: updated

(Not recommended – would likely see fault levels exceed plant capability)

2. HTR – Specify Maximum Fault Level limits

   (A process is recommended rather than specified values (see below), noting that maximum fault levels could fluctuate significantly, and even low maximum fault levels could exceed plant capability, however as a guide it is recommended a note is added to the PHTR to ensure fault levels don't exceed the minimum plant capability of new plant identified above)

3. PNR/HTR – Develop procedure 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. *(Complete – refer "Findings on Fault Level Management", EPWA, 26 September 2024)*
- Develop table of minimum fault withstand ratings for new plant and include in the PHTR. Conduct review of available plant and consider use of Horizon Power Technical Rules Tables A13.1, A13.2, A13.3. Refer to this table in the body of the PHTR.
- Establish a procedure or update an existing procedure to introduce the requirement for NSPs to assess fault levels as part of new connections and system changes. Include a reference in the PHTR to this procedure. The procedure should:
  - Require NSPs to assess fault levels on the Pilbara Grid against fault withstand capabilities of existing plant on the Pilbara Grid.
  - Require NSPs to ensure fault levels on the Pilbara Grid do not exceed fault withstand capabilities of existing plant on the Pilbara Grid
  - Require NSPs to publish fault level withstand capabilities of their plant.
  - Require NSPs to consult other NSPs as part of fault level assessments.
  - Define relevant calculation parameters such as calculation methods, and credible scenarios and contingencies.
- Include in the PHTR a note which requires maximum fault levels at any point will not exceed the minimum fault withstand ratings identified under recommendation 2 above.
- Update Sections 3.2.1(f), 3.2.6(a)(8), 3.4.6, and 5.4.1 for consistency with the above recommendations.

Commented [no3]: agreed, mitigation options should be looked at as well, however this can depend on the situation so engagement with the NSP is important. It may be more cost effective to upgrade equipment (replace a disconnector, upgrade earth grid etc) than to implement mitigations (CLiP, series reactors etc)

Commented [no4]: I do think we are heading down a path where we will have the opposite problem, with insufficient fault levels in certain nodes of the system. System strength assessments are starting to highlight this will become an issue in the future. Who knows, in 10 years time we might be looking at ways to increase fault level across the system! Perhaps the HTR could consider what needs to be done for SCR's of less than 3, less than 2 etc. I don't think it's well understood what to do when SCR's are 1.X for example, which is likely to occur in the future.

Commented [DS5R4]: Agreed - although we may have different problems at different times and in different areas of the system. I think the issue of system strength should be on the agenda of this PNR/HTR review - one for discussion.

Commented [DS6]: The existing Access and Connection procedure could potentially used but is presently limited:
Only new connections >10MW

1. PHTR Issue 29 – Adequacy of requirements for system restart arrangements.

1.1 Issue 29 - Classification

High, Substantive, Technical

1.2 Issue 29 - Description & Discussion

Issue Description

The HTR section 2 lists the network performance criteria that NSPs must comply with. HTR cl. 2.2 describes the power system performance standards which contains the frequency operating standards (HTR cl. 2.2.1) and the voltage magnitudes (HTR cl. 2.2.2) referred to in the definition of "inside the Technical Envelope" in PNR Rule 163.

A system restart scenario involves energising a part or all of the power system and restoring supply to load, after the relevant part has experienced a complete loss of power resulting in a steady-state voltage of zero.

Maintaining frequency and voltage within these operating standards during system restart scenarios has historically been difficult, due in part to the following factors at play following a system or island wide outage:

- The system is usually restarted using one generating unit at a time ("black starting generator"), energising portions of the transmission network by working outward from the black starting generator.
- Prior to commencing the restart, the system is often fractured into islands.
- The above factors mean there is little generation on the system, resulting in unusually low system strength (low capacity to maintain voltage).
- Consequently, any event on the restarting network is likely to cause material frequency and/or voltage fluctuations. This may include actions to switch on substation feeders to restore supply.

This issue[1] deals with the question whether the frequency and voltage operating standards of the HTR should be relaxed during system restart scenarios.

Discussion

System restart is dealt with in R92 of the PNR. This rule sits under Subchapter 7.5 of the PNR.

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[1] Issue 29 initially dealt with requirements in the HTR for system restart arrangements. It was discussed and agreed in the EPNR HTR working group meeting on 10/10/2024 to reframe the issue as presented in this paper.

Subchapter 7.5 has as primary objective to "achieve the System Security Objective".

R162 defines the System Security Objective as the objective to "maintain the power system inside the Technical Envelope where practicable, and otherwise promptly return it to inside the technical envelope."

R163(1)(a) and (b) define conditions for being "Inside the Technical Envelope" as (among others):

- (a) "the frequency at all energised busbars is within the Frequency Operating Standards set out in the Harmonised Technical Rules"
- (b) "the voltage magnitudes are within the normal range set out in the Harmonised Technical Rules at all energised busbars in a switchyard or substation at a Generation Facility, or on a Transmission Network or Interconnector".

In other words, system restart arrangements are intended to achieve the system security objective, which calls for operation inside the frequency and voltage operating standards of section 2 of the HTR, but allows for periods of operation outside these standards where it is impractical to do otherwise, and requires returning the system (or island) Inside the Technical Envelope promptly.

Taken from a different view, the system or island that is subject to a restart scenario is already outside the Technical Envelope. The restart action is part of the effort to promptly restore the system to inside the Technical Envelope and a Secure State.

In conclusion, the PNR already allows a relaxation of frequency and voltage operating standards during the highly abnormal system conditions associated with system restart scenarios, where it is impractical in these scenarios to maintain these standards.

1.3 Issue 29 – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.

Option 2 – Add a drafter's note to the PNR giving system restart as an example where it may be impractical to maintain the system (or island) inside the Technical Envelope.

- The note gives the interpretation guidance to arrive at the conclusions drawn in this paper without changing the legal meaning of the text.
- This can be done either in R162 (system security objective) or in R192 (system restart).

1.4 Issue 29 – Recommended Actions

Option 2 is recommended on the merits described above. Additionally, attention is drawn to the following considerations:

- System restart plans in the Pilbara commonly rely on the fracturing of the power system at points of interconnection, following the event that causes a partial or complete loss of voltage, in order to restore the power system in a sequential manner.

- Operational experience amongst NSPs and the ISO have shown that adequate synchronisation points between registered networks, both covered and non-covered, are essential in the timely and orderly restoration of the power system, and to facilitate maintenance outages of these interconnectors.
- It is recommended to explore a requirement in the PNR or HTR mandating at least one network synchronisation point, capable of synchronising the two networks, on every interconnector between networks of registered NSPs and CPC Facility Networks.

MEETING AGENDA AND MINUTES

Name of Meeting	Location	Date / Time	Written by
CPC – Mtg 1	Online / MSTeams	18/10/2024	Scott Hiscock / Shervin Fani

Attendees

Shervin Fani - Woodside	Peter.VanDenDolder - ISOCo
Scott Hiscock - Woodside	Noel Michelson – Rio Tinto
Guy Tan - Horizon Power	Njabulo (Jay) Milo - BHP

Distribution

EPWA energymarkets@demirs.wa.gov.au

Apologies

N/A

Agenda

- I30 Connection Point Compliance – minutes taken by Woodside representatives.

Meeting Minutes

I30 Connection Point Compliance *Connection Point Compliance parameters and definition (including negotiated vs ideal rules - with particular consideration for brownfield plant vs greenfield). Consider if any updates required to facilitate or improved the treatment of Connection Point Compliance measures*.

Consensus from group was to close this action in the HTR working group and keep the CPC measures within the PNR, avoiding the circular argument identified between PRN/HTRs if changes were made. For completeness it was recommended that this receives confirmation within the PNR working group.

***Note:** For reference completeness - post group meeting #1 N.M. (Rio) highlighted the following which will need to be addressed as a priority:

I refreshed my understanding of the CPC in the PNR and there are linkages between the PNR and HTR that we need to be aware of.
One of these is that a CPC can't progress unless there is a non-compliance with the HTR (PNR Rule 274B(2)(a)(i)).
Meaning, based on our discussion today, if we create a CPC set of rules in the HTR then that would potentially mean compliance can be made with the HTR, meaning CPC can't be applied for. A circular argument may form between the PNR and the HTR.
This same clause also requires each component of equipment to be assessed against the HTR with equipment identified with one or more non-compliances.
So there is potentially PNR changes required to allow compliance with the HTR and still follow the CPC process in the PNR. Also the requirement for each component to be assessed may need to be lifted if the preference is to not assess behind the connection point, or assess at a facility level.
Just thought it would be helpful to raise this, that we probably need to be reading the PNR in conjunction with the HTR for this specific task. It is likely both PNR and HTR requirements are required. Our recommendation to simplify this process may cause problems with the PNR. This interrelationship with the HTR exists for other clauses throughout the PNR as well.

Actions

Item	Discussion and Decisions	Action By	Due Date
1	PNR working group to review circular argument issue around PNR/HTR for CPC should CPC requirement be detailed in the HTR.	EPWA	

Next Steps

PHTR Issue 31 – Determination of Power Transfer Limits

Issue #31 – Classification:

Moderate, Simple, Technical

Issue #31 – Description:

Define who conducts and is responsible for power transfer limits.

Presently, in the Pilbara Harmonised Technical Rules (PHTR), clause 2.3.7.1, the NSP is responsible to plan, design and construct the network to ensure power system stability (cl 2.2.7 Transient rotor angle stability) and dynamic performance criteria (cl 2.2.10 Temporary over-voltages) for credible system load and generation patterns.

In short, the NSP must determine all credible system load and generation patterns to be assumed for the purposes of 2.3.7.1 Short Term Stability. The NSP where practical must determine and set the power transfer limits for different power conditions to not unnecessarily restrict the power transfer capacity made available to controllers.

Presently, the onus of determination of power transfer limits sits with the NSPs. NSP of a covered network must publish the current determined power transfer limits. NSPs must also notify the determined power transfer limits to the ISO for any other NSP that forms the NWIS.

The PHTR doesn't presently provide any guidance on how to determine power transfer limits.

Noting that power transfer limits could be defined by overall system stability constraints, and given the complexity of the studies and information required to determine these, the ISO could potentially take a facilitative role in determination of these limits.

Issue #31 – Solution Options:

1. Continue existing arrangements – NSPs determine transfer limits as requested. No change to PHTR
2. Continue existing arrangements where NSPs determine transfer limits as requested, but update PHTR or develop or augment an associated procedure to define information provision requirements and/or guidelines to assist NSPs to undertake the required studies.

   (Recommended)
3. The NSPs remain responsible but the ISO coordinates the process of a regular review of power transfer limits.
4. The ISO becomes responsible for determination of power transfer limits.

Issue #31 – Recommended Actions:

Option 2 is the recommended option – NSPs continue to be responsible for determining transfer limits. This option recognises that NSPs are best placed to determine transfer limits as they are responsible for the networks and best able to understand overall network constraints (including both static and dynamic constraints).

However, it is recommended additional procedural support is provided to ensure NSPs are adequately supported and equipped with the information required to determine transfer limits (for example system models, clearing times, calculation guidelines).

1. PHTR Issue 32 – Update CFCTs at HP-RTIO interconnectors to reflect system changes and approved derogations.

1.1 Issue 32 - Classification

Moderate, Substantive, Technical

1.2 Issue 32 - Description & Discussion

Issue Description

The HTR Table 2.10 lists the maximum fault clearance times (MFCTs) for various transmission and distribution voltages. The table provides specific MFCTs for the 33 kV interconnectors between Rio Tinto (RTIO) and Horizon Power (HP), and for 33 kV distribution systems generally.

The MFCTs for the RTIO-HP interconnectors at Dampier and Cape Lambert are given as 105 ms. This came from the Horizon Power Technical Rules (standard number HPC-9DJ-01-0001-2012), revision 1.

An independent study of critical fault clearance times (CFCTs) on the NWIS, completed by Jacobs in 2016, suggested a need for CFCTs of 365 ms or faster on the 33 kV RTIO-HP interconnectors. Horizon Power and Rio Tinto ultimately agreed on total fault clearance times of 300 ms.

This was captured by Horizon Power in a formal derogation[1] for the Dampier interconnectors and Dampier Substation from its own Technical Rules in April 2017.

The updated fault clearance times for the RTIO-HP interconnectors were not captured when the HTR was developed. The MFCT of 105 ms is an outdated value and is considered impractical for distribution systems.

Further, the CFCTs on some radial distribution lines may in fact be higher than 300msec and a mechanism is required which allows alternative times on radial distribution feeders where higher CFCTs can be demonstrated.

1.3 Issue 32 – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.
- RTIO-HP interconnectors continue to be subject to MFCTs that are both superseded by recent protection studies and which are impractical.

Option 2 – Amend HTR Table 2.10 to modernise and simply MFCTs.

- Remove the row for “33 kV HP-Rio tie lines”.

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[11] 201704-technical-rules-derogation-for-dampier-33kv-280617.pdf

- All 33 kV systems will be subject to the MFCT of 300 ms.
- If faster clearance times are needed for interconnectors, this can be implemented under HTR cl. 2.6.5 "critical fault clearance times".

1.4 Issue 32 – Recommended Actions

Option 2 is recommended on the merits described above.

Further, it is recommended a reference be added in HTR clauses 2.6.4 and 2.6.5 to radial distribution lines, and the ability of the NSP to utilise higher MFCTs on those lines where it can be demonstrated the CFCTs on those lines are greater than the maximum fault clearing times required in Table 2.10.

PHTR Issue #40 – Overall Review of Referenced Standards

Issue #40 – Classification:

Low Priority, Simple, Technical

Issue #40 – Description:

Several of the standards referenced in the PHTR are outdated, and some have undergone multiple revisions as shown in Table 1. The updates reflect advancements and changes in the field, which are crucial for maintaining accuracy and relevance.

Table 1: Overview of Referenced Standards in PHTR

	Overview of Standards Referenced in PHTR			
	Standards referenced	**out of date?**	**Brief description of the issue**	**Recommendation**
1	Electricity Networks Access Code (2004) (WA)	Current	The Electricity Networks Access Code (2004) for Western Australia is still current, but it has undergone several updates. The latest unofficial consolidated version reflects changes as of May 10, 2026	
2	Pilbara Networks Rules	Current		
3	Electricity Industry Act 2004	Current		
4	WA Electrical Requirements issued under Regulation 49 of the Electricity (Licensing) Regulations (1991) (WA)	Current		
5	WA Distribution Connection Manual	Current		
6	IEC 60255	Current		
7	AS 4777	Current		

8	IEC 62116	Current		
9	Electricity (Network Safety) Regulations 2015 (WA)	Current		
10	AS 2067 for medium and high voltage equipment	Current		
11	Pilbara Networks Access Code (2004)	Out of date	The Pilbara Networks Access Code (2004) has been superseded. The current version of the Pilbara Networks Access Code was established on June 21, 2022	The latest version of the standard should be referenced.
12	AS/NZS 61000.3.7:2001,	Out of date	Superseded by TR IEC 61000.3.7:2013	The latest version of the standard should be referenced.
13	AS/NZS 61000.3.6 (2001)	Out of date	TR IEC 61000.3.6:2012 is current version	The latest version of the standard should be referenced.
14	AS 61000 (2001)	Out of date		The latest version of the standard should be referenced.
15	AS 2344 (1997).	Out of date	The 2016 version incorporated advancements in measurement techniques and instrumentation technology, ensuring the standard remains relevant with current industry practices. The 2016 version expanded the frequency range to 0.15 MHz to 3000 MHz12, providing more comprehensive coverage for modern applications.	The latest version of the standard should be referenced.
16	AS/NZS 61000.4.7 (1999)	Out of date	The 2012 version incorporated advancements in measurement techniques and instrumentation technology, reflecting the latest industry practices and standards. It also included updates to align with the latest edition of the IEC 61000-4-7 standard, ensuring consistency with international standards2.	The latest version of the standard should be referenced.

17	IEEE Standard 115-1983-Test Procedures for Synchronous Machines	Out of date	IEEE 115-2020	The latest version of the standard should be referenced.
18	Australian Standard AS 1359 (1997) or AS 1359 (1998) - "General Requirements for Rotating Electrical Machines	Out of date	AS60034 series. AS 60034.1:2023-Rotating electrical machines Rating and performance	The latest version of the standard should be referenced.
19	AS 60947.6.2 (2004).	Out of date	AS/NZS IEC 60947.6.2:2015 Low-voltage switchgear and control gear Multiple function equipment - Control and protective switching devices (or equipment) is the latest	The latest version of the standard should be referenced.
20	AS/NZS 3000 (2000)	Out of date	AS/NZS 3000:2018 is current	The latest version of the standard should be referenced.
21	Horizon Power Technical Rules of October 2020	Out of date	Horizon Power Technical Rules updated 2/09/2023	The latest version of the standard should be referenced.

Issue #40 – Solution Options:

1. PHTR explicitly state that the most recent version of all referenced standards should be used to ensure compliance and accuracy, and remove any specific references to the applicable year (*Recommended)*
2. Leave as is *(Not a suitable option – inconsistent with review objectives)*

Issue #40 – Recommended Actions:

- PHTR explicitly state that the most recent version of all standards should be referenced to ensure compliance and accuracy. Remove any specific references to the applicable year, such that the most recent version of the standard always applies.

1. PHTR Issue 41 – Better clarity required for definitions of distribution feeder / interconnector / tie (undefined but included in HTR Table 2.10).

1.1 Issue 41 - Classification

Low, Simple, Technical

1.2 Issue 41 - Description & Discussion

Issue Description

The HTR uses the term "tie lines" once in Table 2.10 to denote the Rio Tinto (RTIO) to Horizon Power (HP) interconnectors. This term is not defined in the HTR and not used in the PNR.

The PNR provides a definition for "interconnector".

The proposal for Issue 32 involves removing the only mention of the term "tie lines" in the HTR.

1.3 Issue 41 – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.

Option 2 – Amend HTR Table 2.10 to modernise and simply MFCTs.

- Add the definition of "interconnector" to the HTR section 1.5 which refers to the PNR definition.
- Replace all instances of "tie line" with "interconnector".

1.4 Issue 41 – Recommended Actions

Option 1 is recommended if the proposal for Issue 32 is carried, otherwise Option 2 is recommended.

1. PHTR Issue 42.A – HTR 2.3.2e describes 'essential system services' to be put last for load shedding - however this is different to the defined essential system services ESS as defined in PNR.

1.1 Issue 42.A - Classification

Low, Substantive, Technical

1.2 Issue 42.A - Description & Discussion

Issue Description

HTR 2.3.2(e) describes 'essential system services' to be put last for load shedding. The term "essential system services" is not defined in the HTR, but is defined in PNR as "a service, including FCESS and SRESS, that is required to achieve the objectives in rule 199 and the System Security Objective". The use of this term in the HTR needs to be clarified.

FCESS is defined in r201 of the PNR as "frequency control service". SRESS is defined in r213 of the PNR as "spinning reserve service".

Discussion

The phrase "loads supplying essential system services" in HTR 2.3.2(e) needs to be properly understood.

The Western Power Technical Rules (1 December 2016) and Horizon Power Technical Rules revision 3, which are precursors to the HTR, have the same clause but use the term "essential services" which is defined as "services such as hospitals and railways where the maintenance of a supply of electricity is necessary for the maintenance of public health, order and safety".

This is likely the intended use of the term in the HTR. It is probable that the word "system" in the term "essential system services" is an editorial error.

1.3 Issue 42.A – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.

Option 2 – Replace the term "essential system services" in HTR 2.3.2(e) with "essential services" and define this term in the HTR by copying the definition from the Horizon Power Technical Rules revision 3.

1.4 Issue 42.A – Recommended Actions

Option 2 is recommended based on the discussion in section 1.2 above.

2. PHTR Issue 42.B – Throughout the HTR "ancillary service" is used instead of "essential service" - the PNR and HTR should be aligned with this terminology to avoid confusion.

1.5 Issue 42.B - Classification

Low, Substantive, Technical

1.6 Issue 42.B - Description & Discussion

Issue Description

The HTR uses the term "ancillary services" in a drafter's note for clause 3.1(c) and in cl. 3.2.5.2(d)(3). This term is given the same definition as "essential system services" in the PNR. The term is not used in the PNR.

Discussion

The term "ancillary services" was inherited from the Horizon Power Technical Rules revision 2, which gave the following definition "Services for: voltage control, control system services, spinning reserve and post-trip management". This definition came from a world in which NSPs were the only parties capable of contracting with non-NSP participants for the provision of services essential to their networks' security.

In the PNR these services were given a new name under the term "Essential System Service". Currently this is defined in the PNR as "a service, including FCESS and SRESS, that is required to achieve the objectives in rule 199 and the System Security Objective". r199 of the PNR ensures the ISO Control Desk is equipped with access to the necessary arrangements to maintain and return the power system in a secure state and inside the technical envelope under various circumstances.

The PNR therefore contemplate "essential system services" as services procured for use by the ISO Control Desk to carry out its functions. Currently this includes FCESS and SRESS.

HTR clause 3.1(c)

The note in HTR cl. 3.1(c) clarifies that "the scope of these Rules [HTR] does not include the technical requirements for the provision of ancillary services under these rules or a commercial arrangement with the NSP. Controllers who provide these ancillary services may be required to comply with technical requirements over and above those specified in this chapter [3 of the HTR]. These additional requirements will be specified in the provisions of these rules dealing with the ancillary service or in the relevant ancillary services contract".

Swapping the term "ancillary services" with "essential system services" would not seem to affect the meaning of the note, and is therefore considered appropriate.

HTR clause 3.2.5.2(d)(3)

HTR cl. 3.2.5.2(d)(3) uses the term as it deals with the requirements of a generator's protection system and other controls to ensure "prevention of the generator's generating unit from energising de-energised NSP equipment, or energising and supplying an otherwise isolated portion of the network except where a generator is directed under the Pilbara networks rules to provide a black start ancillary service".

In this instance, swapping "ancillary service" for "essential system service" may limit the application of this clause to generating facilities that are contracted by the ISO for the provision of ESS under the PNR. The PNR currently does not provide the ISO with the head of power to procure ESS contracts for black start services. Instead, black start arrangements are dealt with in r192 which requires NSPs to develop and implement system restart arrangements.

With the current definitions and use of "ancillary services" and "essential system services", it is likely already the case that this clause of the HTR is ineffective.

The EPNR workstream for the PNR is considering the expansion of essential system services to include other services besides FCESS and SRESS. It is recommended to address the inconsistency in 3.2.5.2(d)(3) through this item in the PNR stream.

2.3 Issue 42.B – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.

Option 2 – Replace the term "ancillary services" with "essential system services" throughout the HTR.

- Removes a redundant term and makes the use of language between the PNR and HTR consistent.

2.4 Issue 42.B – Recommended Actions

Option 2 is recommended based on the discussion in section 1.2 above and with the following considerations.

- Swapping "ancillary service" for "essential system service" in HTR cl. 3.2.5.2(d)(3) may limit the application of this clause to generating facilities that are contracted by the ISO for the provision of ESS under the PNR.
- With the current definitions and use of "ancillary services" and "essential system services", and as the ISO cannot procure black start contracts under the PNR, and since these services are procured by NSPs through network access contracts under r192, it is likely already the case that this clause of the HTR is ineffective.
- The EPNR workstream for the PNR is considering the expansion of essential system services to include other services besides FCESS and SRESS. It is recommended to address the inconsistency in 3.2.5.2(d)(3) through this item in the PNR stream. This can be done, for example, by

- requiring NSPs to procure black start ESS; or
- introducing a new term for network support services procured by NSPs and updating HTR cl. 3.2.5.2 to include this term (preferred as it avoids the need for another market, taking advantage of existing arrangements between NSPs and generators); or
- requiring the ISO to procure black start services.

1. PHTR Issue 43 – Is accumulated synchronous time error still required? Has been removed from NEM.

1.1 Issue 43 - Classification

Low, Simple, Technical

1.2 Issue 43 - Description & Discussion

Issue Description

'Accumulated synchronous time error' is defined in the HTR as "means the difference between Western Australia Standard Time and the time measured by integrating the instantaneous operating frequency of the power system".

The term is used in section 2 of the HTR dealing with transmission and distribution system performance and planning criteria. Clause 2.2 lays out the power system performance standards, and cl. 2.2.1(b) states "The accumulated synchronous time error must be less than 10 seconds for 99% of the time over a period of 24 hours".

This issue raises the question whether this clause is still relevant and necessary in the HTR, particularly in the context of the same technical criteria being removed from the National Electricity Rules (NER) that apply to the National Electricity Market outside of Western Australia.

Discussion

On 6 April 2023 the Australian Energy Market Commission (AEMC) released its final determination for its review of the frequency operating standards in the NEM. This determination included the removal[1] of the limit for accumulated time error, a measure equivalent to the HTR's accumulated synchronous time error.

The summarised justification was given as follows:

"The Panel has determined to remove the limit on accumulated time error from the FOS. This provides AEMO with greater flexibility to adjust its systems and procedures as required, while maintaining the existing reporting requirements through its weekly and quarterly frequency performance reports".

While NER changes are insightful, there are (and will likely be for some time) significant differences in the procurement and implementation of regulation reserve (FCESS) between the Pilbara and the NEM. Some key differences are drawn out below:

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[1] https://www.aemc.gov.au/sites/default/files/2023-04/REL0084%20-%20Final%20Determination.pdf , see top of page ii.

- In the NEM, AEMO has the power to monitor and adjust parameters for FCESS (including accumulated time error) in real time.
- In the NWIS the ISO has no such power and relies on the FCESS provider to monitor and set these parameters.
- In the NEM, all FCESS is implemented by AGC through a centralised dispatch engine.
- In the NWIS, FCESS may be supplied by AGC or Isochronous control.
- Under clause 4.8.16 of the NER, AEMO will continue to prepare and publish quarterly reports on the achievement of the FOS including rate of time error accumulation. This is a key condition of the decision to remove the requirements from the NER.
- The ISO does not have the obligation nor the capacity to conduct this reporting.

Time error in the NWIS

A discussion amongst NWIS participants yielded the following observations:

- Synchronous time error is used in the provision of AGC for frequency control.
- Measurements of accumulated synchronous time error over a period of time is a reliable and useful metric of the effectiveness of the frequency control provider.
- Historically some consumer devices in the NWIS relied on frequency to provide a time reading e.g. oven and microwave oven clocks. While these devices are phasing out, they are still present on the system.
- The Horizon Power Technical Rules (HP TR) allow moving outside the permitted accumulative synchronous time error bands during periods of high penetration of distributed electricity resources (DER).

1.3 Issue 43 – Solution Options

Option 1 – Do nothing.

- No changes to the PNR or HTR.
- Recommended as providers of FCESS in the NWIS often rely, in part, on the standard for accumulative synchronous time error to determine effectiveness of the service.

Option 2 – Remove requirement and make a provision for the ISO to set and enforce standards within frequency control contracts.

- Only works for the primary FCESS contract as provision of FCESS in islanding scenarios is done by Secondary FCESS providers under PNR r205 and r209 without a contract with the ISO.
- Requires the ISO to determine an appropriate standard, rather than pointing to an agreed standard in the HTR.

1.4 Issue 43 – Recommended Actions

Option 1 is recommended based on the discussion in section 1.2 and 1.3 above.

Issue 44

Note: Status update from the working group. Active discussion on some of these topics is ongoing. Recommendation may need to be adjusted once these conversations conclude.

As provided by Noel Michelson to EPWA by email (05 November 2024)

Issue I44 "definition of back up protection for tie lines"

Issues identified:

- The reference to "a part of the distribution system" .. that .. "may potentially form a separate island" and application to "the protection system that provides protection against Islanding" is potentially open to interpretation.

- The present rules don't reflect the critical nature of interconnectors operating at distribution voltages, which need to overcome challenges in bi-directional power flow, sudden power swings, and complex grading between the two networks. We see interconnectors more as being part of the transmission system, not the distribution system.

- As it stands, having a single main protection and backup protection on interconnectors places at risk the ability to comply with maintenance requirements of HTR 2.6.2.(a)(3) – having two fully independent protection schemes of differing principle (not one which is a main protection and one which is a backup protection) is more robust, appropriate and suitable for maintenance purposes. Also noting that HTR 2.6.2.(a)(3) implies that the main protection system comprises two fully independent protection schemes (i.e. not a main and backup) due to the ability of the backup scheme to share protection apparatus of the main scheme. Again this is a little bit open to interpretation in the context of HTR 2.6.2.(b) and we think could be spelled out a bit more clearly.

- Redundancy (N-1 of tie lines) to be considered in terms of maintenance requirements. Should online maintenance activities be occurring when redundancy exists and the feeder can be safely isolated.

- Availability of duplicate DC systems, trip coils, duplicate CTs/VTs need to be considered if a fully duplicate system is required.

Recommendation:

- Establish a subsection in the HTR 2.6.2 which specifically deals with requirements of disconnectors.

- This should make reference to the nature and the role the tie line plays in the broader system, availability requirements of the tie line for it's specific application (with regard to redundancy with other tie lines) and technical requirements to ensure the stability of the system.

- The focus should be on avoiding the need to form a separate island (during maintenance activities, normal operation, etc)

Issue 45

Note: Status update from the working group. Active discussion on some of these topics is ongoing. Recommendation may need to be adjusted once these conversations conclude.

As provided by Noel Michelson to EPWA by email (05 November 2024)

Issue I45 “Modelling Guideline”

- Earlier this year ISOCo released the Interim Power System Modelling Procedure
- This procedure appears adequate to cover the requirements of the combined NWIS whole of system model.

Recommendation:
Item closed with no change necessary