REVIEW OF NEM POWER SYSTEM DATA COMMUNICATIONS STANDARD

ISSUES PAPER

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EXECUTIVE SUMMARY

The publication of this Issues Paper commences the first stage of the Rules consultation process conducted by AEMO to amend the Power System Data Communications Standard for the NEM (Standard) under the National Electricity Rules (NER).

The Standard[1] sets out requirements which participants identified as 'data communication providers' (DCPs) must comply with in providing, maintaining, and operating the equipment and systems used in the transmission and receipt of power system data and electronic instructions to and from NEM control centres. Under the NER, these requirements apply to network service providers, registered generators, certain customers, demand response service providers, and providers of ancillary services and other system security services.

The Standard incorporates requirements and protocols covering matters including:

- Data representation, quality, and latency
- Remote control response times
- Reliability of facilities and equipment
- Security of equipment and data
- Data protocols and interfacing with AEMO
- Maintenance requirements such as outage response time.

This Standard was first established in 1998 and has been reviewed at periodic intervals, most recently in 2017. AEMO has determined that a further review is now necessary due to ongoing changes in the NEM power system, and recent changes to the NER.

This review will consider amendments to the Standard both to address current issues with the content, application, and interpretation of the Standard, and consider how the Standard could be adapted to accommodate communication needs effectively and efficiently for emerging changes in the NEM power system.

AEMO has prepared this Issues Paper to facilitate informed debate and feedback on the most efficient way to meet the objectives for this Standard in the NER for current conditions and reasonably expected developments in the NEM, having regard to the national electricity objective.

The matters canvassed in this Issues Paper have been informed by preliminary engagement with energy industry participants and other market bodies. AEMO has identified approximately 50 discrete topics for review, which are grouped under 18 separate headings in this Issues Paper. Some of the key themes include:

- Need for more responsive control loops.
- Data latency
- Lack of specificity in requirements regarding data quality and reliability
- Need to meet latest expectations regarding security of data related to critical infrastructure
- Need to be clearer on obligations of different parties and boundaries of responsibility between them.
- Changing nature of the power system and the NEM

[1] The current version of the Standard is at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf

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AEMO notes that it may not be possible to immediately address all identified issues within this consultation for reasons of practicality, and that some issues may require policy decisions or regulatory changes before they can be considered for the Standard.

At this first stage of formal consultation on this review, AEMO is seeking feedback on the materiality and impact of these issues, and any proposed solutions, options, or impediments for change. AEMO requests that the expected costs and benefits of any proposed solution are identified in submissions to the extent possible. Respondents may also wish to identify any further issues that they believe should be considered in AEMO's review of the Standard.

Stakeholders are invited to make written submissions on this Issues Paper, in particular on the questions identified throughout the paper, by 5.00 pm (AEDT time) on 15 March 2022. Submissions must be made in accordance with the requirements set out in the Notice of First Stage of Consultation published with this paper.

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CONTENTS

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1. STAKEHOLDER CONSULTATION PROCESS

1.1 Commencement of formal consultation

As required by clause 4.11.2(c) of the NER, AEMO is consulting on its review and amendment of the Power System Data Communications Standard for the NEM (Standard) in accordance with the Rules consultation procedures in rule 8.9. AEMO is extending this consultation beyond Network Service Providers to all registered participants and interested parties, since the requirements in the Standard affect the obligations of registered generators, some customers, demand response service providers, and providers of ancillary services and other system security services.

AEMO's indicative timeline for this consultation is outlined in the table below. Future dates may be adjusted depending on the number and complexity of issues raised in submissions and any meetings with stakeholders. Additionally, noting the breadth of this Issues Paper, AEMO recognises that it may be appropriate to provide an opportunity to comment on a second draft of the Standard, or alternatively to implement amendments in two or more stages, potentially with extended consultation on some issues. These steps will be considered as the consultation progresses.

Deliverable	Indicative Date
Issues Paper published. First stage consultation period opens	Thursday 3 February 2022
Submissions close on Issues Paper	Tuesday 15 March 2022
Draft Report and draft Standard published. Second stage consultation period opens	Tuesday 12 April 2022
Submissions close on Draft Report and draft Standard	Thursday 19 May 2022
Final Report and final version of Standard published	Thursday 9 June 2022

Prior to the first stage submissions due date, stakeholders can request a meeting with AEMO to discuss the issues raised in this Issues Paper.

1.2 Prior consultation undertaken by AEMO

To inform the issues to be considered for consultation in AEMO's review of the Standard, AEMO extended an invitation to interested stakeholders to provide feedback on the Standard, in an AEMO Communication bulletin on 21 October 2021. AEMO also directly contacted NEM participants, government and market bodies thought to have a particular interest in the Standard.

AEMO held a series of four targeted workshops attended by a wide range of stakeholders who expressed an interest in participating in that stage. These were:

- NSPs – 26 October 2021
- Market Participants including generators, battery storage providers, demand response providers and aggregators – 18 November 2021
- Cyber security experts – 19 November 2021
- Market bodies – 2 December 2021

Stakeholders who either participated in workshops or submitted written feedback identified several issues relating to the standard, with:

- 27 issues from NSPs

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- 9 issues from Market Participants
- 12 issues from cyber security experts
- 3 issues from government or regulatory agencies.

AEMO has used the feedback provided by stakeholders through this process to help formulate this Issues Paper, together with further issues and observations gathered from AEMO's own operational experience and expertise.

Some of the specific points identified in the preliminary engagement process have been consolidated with similar issues on the same theme for consultation purposes.

1.3 Structure of this paper

The remainder of this Issues Paper is structured as follows:

- Section 2 explains the NER requirements that establish the scope and application of the Standard and the context for the review AEMO is currently undertaking.
- Section 3 provides an overview of the substantive issues identified by AEMO and stakeholders in the initial process, and which AEMO is initially considering as part of this review. These are divided into issues with the current Standard (section 3.1) and emerging issues (section 3.2).
- Section 4 summarises the issues for consultation in table form.
- Section 5 highlights the immediate next steps in the consultation.
- There is a glossary of terms used in this Issues Paper at Appendix A.

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2. BACKGROUND

2.1 NER requirements

The Standard is made under clause 4.11.2(c) of the National Electricity Rules (NER) and relates to the facilities and equipment used for transmitting data and signals to and from AEMO for the purposes of its market and power system security functions. The Standard incorporates the standards and protocols referred to in clause 4.11.1 and 4.11.2(a) of the NER and referenced in the network access standards in the schedules to Chapter 5 of the NER.

The purpose of the Standard is to set out the standards and protocols with which Data Communication Providers (DCPs) must comply for:

- Installing and maintaining remote control and monitoring equipment
- Providing and maintaining communication facilities for transmitting data and instructions to and from NEM control centres.

Under the NER, the communication standards and protocols in the Standard apply to DCPs in the following categories:

(i) Network Service Providers (NSP) under clause 4.11.2(a) of the NER;

(ii) Generators under clauses 4.11.1(a) and S5.2.6 of the NER, subject to relevant conditions of their performance standards;

(iii) Customers (in respect of substations, where required by their agreed performance standards) under clauses 4.11.1(a) and S5.3.9 of the NER;

(iv) Market Network Service Providers (in respect of substations) under clauses 4.1.1(a) and S5.3a.4 of the NER, subject to relevant conditions of their performance standards;

(v) Providers of ancillary services, system strength and inertia services under clause 4.11.1(b) of the NER;

(vi) Demand Response Service Providers under clause 4.11.1(c1) of the NER.

2.2 Context for this consultation

AEMO has collated a wide range of issues for review in relation to the subject matter of the Standard, identified by stakeholders and by AEMO itself in the course of NEM operations. For the purposes of its review, AEMO has separated these into issues relating to the Standard's current application and requirements, and issues that may need to be addressed to support efficient and effective data communication across the range of facilities, services and operational requirements expected to exist in the NEM in the relatively near future.

Current issues identified to date include:

- AEMO's Automatic Generation Control (AGC) scheme needs more responsive control loops.
- Data latency is an issue with, in some cases, data being tens of seconds old before being received by AEMO.
- Lack of specificity in requirements regarding data quality and reliability.
- The current Standard does not reflect the latest expectations regarding security of data related to critical infrastructure.
- Insufficient clarity on obligations of different parties and boundaries of responsibility between them.

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- No specific time requirement to resolve issues with data communications.

Looking to the future, AEMO is keen to ensure that, as far as practicable, the Standard can accommodate the significant changes expected in the NEM over the next two to three years. These include growth in:

- Wholesale demand side response aggregators
- Virtual Power Plants
- Energy storage systems
- Aggregators of small-scale generators
- The number of distribution-connected solar farms.

The implementation of the Scheduled Lite Visibility Model is also expected to occur in this timeframe.

Thus this review aims to look forward to some of the emerging issues that may impact NEM data communications requirements as a result of the ongoing power system transition and reforms. These may include:

- Developing more appropriate methods of data communication for smaller embedded generators and aggregators.
- The possibility of direct data connection to AEMO for some participants, including use of alternative interfaces and data protocols.
- The need to cover new sources for real time data such as phasor measurement unit (PMU) data.

While it may not be possible to address every issue (particularly for future development) in the next version of the Standard, where a need is established through this review it is intended that a process will be identified to address that need in a timely manner.

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3. ISSUES RELATING TO THE STANDARD

3.1 Issues with the current Standard

3.1.1 Scope and Application of Standard

The Standard may need to be to be expanded to cover existing situations in a number of aspects.

Data to be provided

Currently the Standard in Section 2.1 states that:

> "(a) DCFs[2] must be capable of transmitting all Operational Data required by AEMO and includes all data that:
>
> (i) was in use at the time this Standard came into effect;
>
> (ii) has been requested in writing by AEMO; and
>
> (iii) has not been subsequently rejected in writing by AEMO.
>
> (b) The transmission of additional Operational Data beyond that required by AEMO under the NER or any agreement between AEMO and a DCP does not diminish the obligations of the DCP to comply with this Standard."

Some stakeholders suggested that the Standard needs to be more definitive on the range of measurements that need to be provided as there is significant uncertainty as to what will actually be required for new connections.

AEMO notes, however, that the Standard cannot itself set obligations as to the data that must be provided to AEMO; it can only refer to obligations set by other provisions in the NER, such as access standards.

Definition of power system data

The current Glossary in the Standard defines 'power system data' as:

> "Data concerning all plant within:
>
> 1. A Substation containing plant that operates at a nominal voltage of at least 220 kV.
>
> 2. A Substation having at least four sources of supply, including power station sources"

Some stakeholders indicated that, with the growth of embedded generation and the need for AEMO to monitor power flows in distribution systems which impact on the security of the transmission network, this definition needs to be expanded.

Definition of control commands

The current Standard defines a control command as "A representation of an instruction to perform a defined action (for example a generation increase)."

Some stakeholders suggested that this definition is inadequate as it does not cover the full range of control commands sent out from AEMO NEM control centres.

[2] DCFs- Data Communication Facilities

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Definition of RCE and RME

The current Standard defines Remote Control Equipment (RCE) as "Equipment used to control the operation of elements of a power station or substation from a control centre", and Remote Monitoring Equipment (RME) as "Equipment installed to enable monitoring of a facility from a control centre".

These definitions may no longer adequately describe new technology for data acquisition.

For example, does RCE include SPS (Special Protection Schemes), RAS (Remedial Action Schemes), RPC (Reactive Plant Control), LOLS (Line Overload Load Shedding), and other CB operated schemes, etc? Does RME include DLR, DTR (dynamic transformer rating), QoS monitors, HSM (high speed monitors), PMU (phasor measurement units), Disturbance Recorders, etc?

Participants in the data communications process

Some stakeholders noted that the Standard in Section 1.1 does not include the full range of participants involved in the data communications process. Examples of omissions are

- participants providing inertia and system strength services
- data from major industrial loads
- virtual power plants
- aggregated DER.

AEMO notes that a number of NER changes effective since the last review of the Standard need to be recognised, in particular to add demand response service providers and system strength and inertia providers.

Questions

- Does the Standard need to be more specific on the range of data covered by the Standard? If so why and what level of detail is considered necessary?
- Does the definition of power system data need to be extended? If so why and what would be a more appropriate definition?
- Does the definition of control commands need to be extended? If so why and what would be a more appropriate definition?
- Do the definitions of RCE and RME need to be extended? If so why and what would be a more appropriate definition?
- Other than changes required to accommodate additional participant categories identified in clause 4.11.1 of the NER, does the Standard need to extend or specify other participants or sub-groups within a category. If so, how and why?

3.1.2 General Issues

Tailoring of Requirements

Some stakeholders suggested that the requirements set under the Standard for different classes of data need to take into account the use of the data and its criticality.

Consistency of the Standard with other requirements

Some stakeholders suggested that AEMO requires more stringent requirements than those in the Standard in other instruments dealing with specific matters (e.g. the Market Ancillary Service Specification).

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Is the Standard still relevant to the changing nature of technology?

Some stakeholders commented that the Standard seems to assume that all participants in the data communications process operate data centres.

Encouraging Resilience through Design

A stakeholder observed that there is an opportunity to design vulnerability out and design security in, as opposed to putting in place processes to manage the emergence of security issues. It was suggested that the Standard could possibly encourage enhancement of resilience through design.

Consequences of failing to meet the requirements of the Standard

One stakeholder advocated for the Standard to be clear on the consequences for a participant failing to meet the requirements of the Standard.

Questions

- Should requirements under the Standard be varied according to how critical the data is? If so what criteria should be used to determine the requirements particular data needs to meet?
- Are there examples where AEMO has specified requirements beyond those set in the Standard and how can any potential inconsistencies best be reconciled?
- Are there examples where the Standard has not kept pace with developments in data communications technology?
- Is there an opportunity for the Standard to encourage enhancement of resilience through design? If so, how might this be done?
- Should the Standard set out the consequences for a participant failing to meet its requirements?

3.1.3 Architectural Requirements

Requirements for DNSPs

The requirements specified for DNSPs in the current Standard may be unclear in a number of areas. Examples that have been suggested are that the Standard:

- Does not reflect the topology that applies for a DNSP (e.g. does not seem to be covered in diagram in Section 1.3 and tables 4 and 5).
- Needs to state whether or not a DNSP can have direct connection with AEMO rather than going through the TNSP.
- Needs to account for diversity in communications s between TNSP/DNSP to AEMO.
- Standard needs to address the situation where there are two or more intervening facilities.

Connection of new participants

Stakeholders have observed that the current data communications structure is making it difficult for new connections.

Special issues for embedded participants

It has been reported that wholesale demand response providers are finding it very difficult to be connected for data communications under current arrangements.

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New embedded scheduled and semi-scheduled generators have obligations under the rules and Generator Performance Standards (GPS) to participate in Automatic Generation Control (AGC). However, some stakeholders have indicated that this is not possible through some DNSP SCADA systems.

Questions

- What changes to the current Standard are required to clarify the requirements for DNSPs?
- Are there specific examples where the current data communications structure is making it difficult for new connections or embedded participants? If so what changes in the Standard would be required to address these issues?
- What difficulties are wholesale demand response providers finding to arranging to be connected for data communications under current arrangements.
- What difficulties do DNSPs have in communicating AGC control signals?

3.1.4 Data Protocols

Secure ICCP

The current Standard specifies ICCP IEC60870-6 TASE.2 and its extensions as a secure ICCP protocol. A stakeholder has questioned whether this can actually be considered a secure protocol.

Connections to AEMO WAN

A stakeholder suggested that the Standard in Section 5.1 needs to be more specific on protocols used when AEMO WAN is connected to another party's DCF.

Questions

- Is the current ICCP Protocol specified in the current Standard still appropriate?
- What protocols should apply for connections to AEMO WAM?

3.1.5 Interfacing

Boundary of responsibilities

Some stakeholders indicated that the Standard needs to provide more clarity on the boundary of both operational and financial responsibility between:

- Generator and NSP
- DNSP and TNSP
- AEMO and TNSP.

Joint responsibilities

A stakeholder observed that in some cases two parties are required to work together to ensure a requirement is met. It was suggested that the Standard should state the obligation of parties to work together to resolve such problems.

Connection to both AEMO sites

One stakeholder stated that Standard needs to be clear that connections are required to both AEMO control room sites.

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Questions

- What additional detail is required in the Standard to provide more clarity on boundary of both operational and financial responsibilities?
- Should an obligation for parties to work together be added to the Standard?
- Does the Standard need to clarify that connection is required to both AEMO control room sites?

3.1.6 Data Quality

Some stakeholders indicated that the Standard needs a specific requirement that data sent is of good quality. It is possible for a connection to be available and the data to be unusable due to quality.

Others have noted that some remote metering equipment does not provide quality flags.

Questions

- Should the Standard include a specific requirement that data sent should be of good quality? If so, what would be implications for stakeholders?
- Should all data be sent with quality flags? If so, what would be implications for stakeholders?

3.1.7 Data Accuracy

Accuracy Requirement

Some stakeholders observed that the Standard does not have an effective requirement to ensure the accuracy of data, in particular to ensure that RME remains calibrated. They believe that monitoring and remediation is problematic (e.g. kilovolt (kV) measurements at some stations can vary by over 10kV).

Metering of semi-scheduled generating units

A stakeholder raised a specific issue with metering of semi-scheduled units, namely that all semi-scheduled units were clamped in SCADA (at the AEMO end) such that telemetered MW values could not be negative. This was considered undesirable, noting that participants are responsible for providing accurate data and separate metering of auxiliary loads.

Questions

- Should the Standard include a more specific requirement regarding data accuracy? If so, what would be implications for stakeholders?
- How material is the issue regarding clamping of values for semi-scheduled units? If the standard were to be changed as suggested, what would be the implications for participants?

3.1.8 Data Latency

Data latency is basically the time it takes for data to be transmitted from the field to AEMO and from AEMO to the field. The current hierarchical architecture of the NEM power system data communications process (refer Section Error! Reference source not found.) can introduce significant delays, in particular for embedded generation and storage.

Some data can be many tens of second old before AEMO receives it, which is creating significant issues for real time operational applications and other processes dependent upon analysis of real time data (e.g. the

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causer pays algorithm and FCAS delivery). It may also be creating issues for participants in when receiving controls from AEMO. Particular issues are described below.

Definition of data latency

Some stakeholders have identified that the Standard is not clear on requirements for data latency or end-to-end response times. There is currently no minimum requirement for data latency.

Time stamping

The experience of some stakeholders has been that significant timing differences can exist particularly for RME that uses coordinated universal time (UTC) and the conversion of this to AEST. Greater clarity may be required on the requirements for calibration, testing, validation, and maintenance of the time stamp quality.

Monitoring of data latency

One stakeholder observed that monitoring end-to end update times is difficult post commissioning.

Questions

- Should the Standard include a specific requirement regarding data latency? If so, what would be implications for stakeholders?
- How material is the issue regarding timing differences due to RME? If the Standard were to be changed to address this, what would be the implications for participants?
- Should an additional requirement be included in the Standard to allow ongoing monitoring of end-to-end response times? If so, what would be the implications of such a change?

3.1.9 Control Commands

Automatic Generation Control response

Some stakeholders identified that the AGC is showing performance issues which suggest that a more responsive control loop is needed. With the current 4 second AGC cycle, some stakeholders believe updates at a minimum of less than 2 seconds are required.

There have been incidents where AGC used to control a battery is stale (20 seconds old) resulting in unwarranted discharge and charge cycles and at times oscillations. This is mainly because the communication delay is more than 97% of the response delay time.

Increased need for remote control from AEMO

Some stakeholders believe that there should be increased use of dispatch signals via SCADA through the NSP, on the basis that their connection to AEMO's Market Portal was considered unreliable and any failure to meet dispatch requirement increases system risk.

Definition of delays in the Standard

The specification of maximum delays may not adequately take into account the number of intervening facilities through which the command signal needs to be relayed.

Questions

- What would the implications be if the specification of maximum delay for control commands was tightened to 2 seconds? What are the implications if control command delays remain at current levels?
- How material is the issue of unreliability of connection to AEMO's market portal?
- Should the specification of control command delays in the Standard take into account the number of intervening facilities? If so, how should these be accounted for and what would the implications be?

3.1.10 Security

Obligations of parties

It has been observed that the current Standard does not include clear obligations with regard to the security of the data (physical, personnel and cyber) and of control protocols at the level required for nationally important critical infrastructure.

The interconnected nature of energy infrastructure means that the compromise of one entity can have cascading effects that disrupts others, potentially with catastrophic effects where this causes prolonged and widespread failure in energy infrastructure.

In enhancing the Standard, security obligations should be appropriately addressed by all parties. DCPs and AEMO should have robust programs in place to adequately and continuously manage security risks that could adversely impact power system communications and supporting systems and infrastructure. Specifically, these programs should address physical, personnel, cyber, and supply chain security risks.

In 2018 AEMO established the Australian Energy Sector Cyber Security Framework (AESCSF) to assist energy sector organisations in understanding their criticality to grids and markets, their current maturity with respect to eleven practice domains, and appropriate criticality-based target states for maturity. A representation of the framework is provided below.

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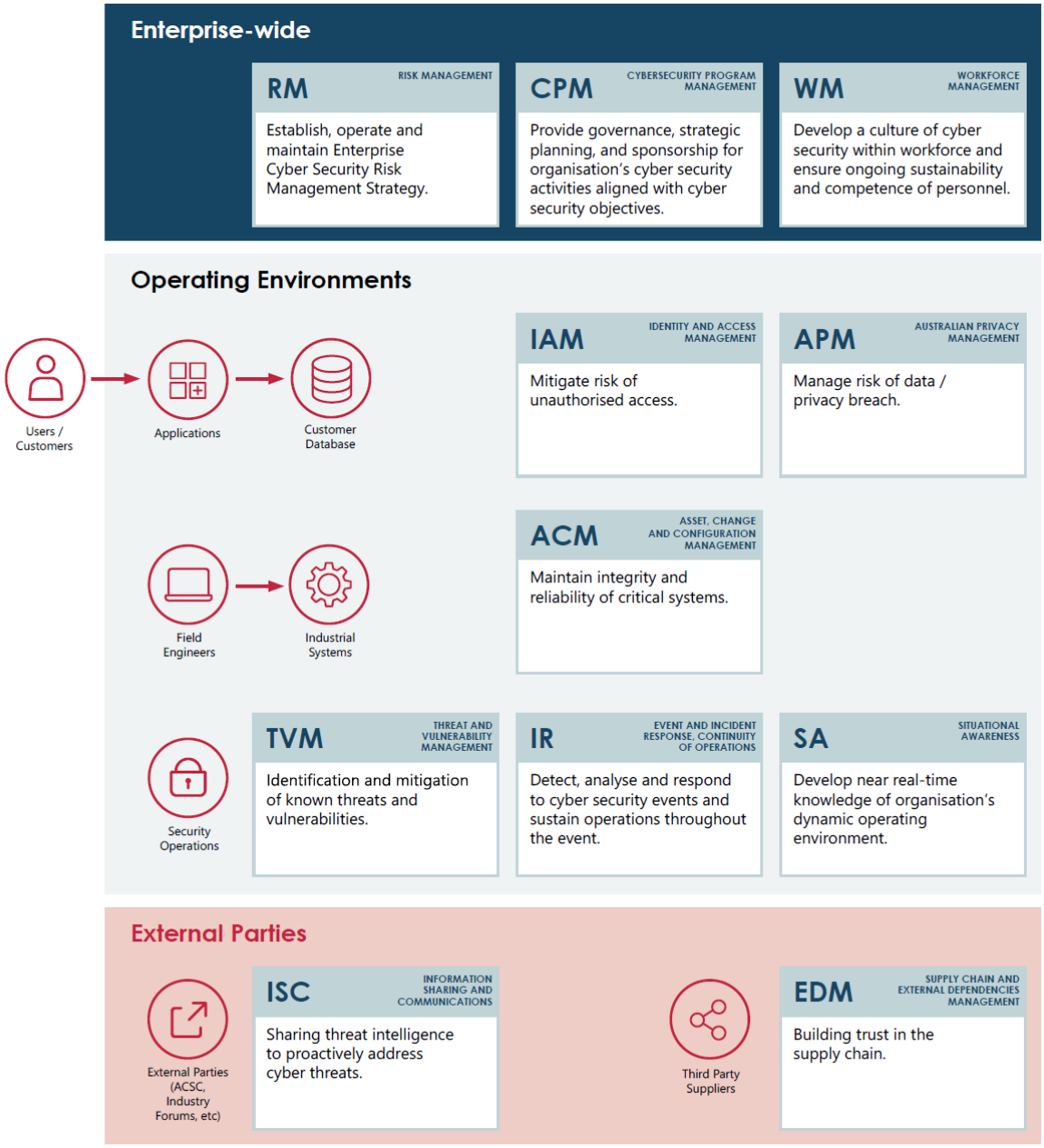

Further to the AESCSF, the Commonwealth Department of Home Affairs introduced amendments to the Security of Critical Infrastructure Act (SOCI Act) in December 2021 that, amongst other requirements, places positive security obligations on entities covered by the legislation. These positive security obligations, when switched on for a sector, require covered entities to provide required details to the Register of Critical Infrastructure Assets as well as an obligation to report cyber security incidents to the Australian Cyber Security Centre (ACSC) within specific timeframes.

Proposed updated security requirements to the Standard include:

- Organisations actively participate in the AESCSF assessment process (either the full or lite assessment depending on criticality) and have a programme in place to achieve criticality-based maturity targets under that framework;
- Organisations have processes in place to detect and report to AEMO security incidents with an impact, or likely impact, to systems related to the data communications or supporting functions; and

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- Organisations have processes in place to exercise cyber response capabilities and address identified opportunities.

Further amendments addressing enhanced security obligations for systems of national significance, the most critical elements of critical infrastructure, are expected to be introduced in early 2022. These amendments will likely place enhanced security obligations on covered entities to develop cyber security incident response plans, conduct cyber security exercises to build cyber preparedness, perform vulnerability assessments to identify vulnerabilities for remediation, and an obligation to provide system information to build Australia's situational awareness.

Alignment with Security of Critical Infrastructure Rules

Some stakeholders have identified that alignment between the Standard and these current and proposed regulations requires consideration. Specifically, does the legislation adequately cover security obligations and requirements for power system data communications, or is there a need for more detailed obligations in the Standard? What approach should be taken to aligning and referencing the legislative obligations and requirements and expanding upon these within this Standard if required?

Advice on cyber security risks

Some stakeholders have identified the need to include an obligation in the Standard for participants to advise AEMO of any known relevant cyber security issues or when abnormal risks to cyber security arise. Should these be coupled with or have the same requirements as those proposed under the SOCI Act rules?

Protection of confidential information

There are questions of who owns the data, who has control of the data and when, and who has rights to it and when. While these are not specifically related to the Standard, it has been suggested that the Standard must nonetheless fully support and enable these requirements.

Questions

- What specific obligations regarding maintenance of security should be included in the Standard and would be the implications of this?
- Does the legislation adequately cover security obligations and requirements or is there a need for more detailed obligations in the Standard?
- What would be the implications of including a specific obligation for DCPs to advise on cyber security risks?
- Should the Standard be enhanced to better identify and support the protection of the confidentiality of data? If so what type of enhancement is required?

3.1.11 Reliability

Definition of requirements for reliability

A number of stakeholders identified the need for greater clarity in Section 3.1 of the Standard regarding the specification of reliability requirements. In particular:

- In table 4 the standard term RCE needs to be better defined.
- Tables 4 and 5 are not clear. For instance, does the 6 hour requirement apply to a single site or all sites?
- Possible inconsistency between tables 4 and 5.

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- Difficulty in understanding how tables 4 and 5 apply to DNSPs.
- Need to better define what is meant by a critical outage in Section 3.1, i.e. does it refer to total loss of data or simply loss of a redundant path?

Monitoring of reliability

Some stakeholders suggested that the Standard should set expectations on the level of monitoring and reporting of reliability that is required. For instance, should a comprehensive heartbeat facility be required?

Application of software patches

Frequent and rapid applications of software patches are becoming an increasing requirement for maintaining cyber security. One stakeholder queried whether new or additional redundancy may be needed at DCFs to allow rapid application of patches without disrupting operations.

Questions

- What changes would be required to clarify reliability requirements in the Standard?
- Does the Standard need to set enhanced expectations regarding monitoring and reporting of availability and why? What would be reasonable expectations to set? What changes would be required to data communications systems to achieve enhanced monitoring and reporting of availability?
- Does any lack of redundancy currently restrict the ability of participants to apply software security patches in a timely manner?

3.1.12 Maintenance

Section 2.2 of the current Standard states that "DCPs must notify AEMO of their sign convention when applying to AEMO for registration as a Registered Participant. To change the sign convention, DCPs must give 60 business days' notice to AEMO". A stakeholder queried whether this requirement applies to small scale changes to correct individual sign conventions or only to a major change following a change in policy.

Questions

- What change to Section 2.2 of the Standard would be required to clarify the requirement for adequate notice?

3.1.13 Response to Failures

A stakeholder observed that the Standard has no specific requirements for the times required to return to service following forced outages and that in practice failed data can take a long time to rectify. Tables 4 and 5 of the current Standard refer to a reliability requirement rather than a specific response time.

Questions

- What issues have arisen that would justify including in the Standard a specific requirement regarding response time to forced outages? If so, what would reasonable expectations be?

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3.1.14 Testing

Scope of testing

Stakeholders observed that the current testing scope does not include testing whether the data is correct. The current testing only confirms that data is being communicated. Other stakeholders have urged that the scope of testing specified under the Standard include testing for cyber security.

Another stakeholder observed that "our experience is that the RCE and RME are not being robustly tested, calibrated and validated. For example, greater requirement for testing of "Control Commands" via point-to-point testing then status and value indications. There is a greater requirement for calibration of timing data for status, value and high-speed data to allow for accurate alignment system events and incident investigations".

Testing Requirements

A stakeholder suggested that the level of testing required for new generators is onerous.

Definition of an upgrade

A stakeholder noted that Section 6.4 of the current Standard is not clear on what constitutes an "upgrade".

Test Procedures

A stakeholder commented that that the requirement under Section 6.4(c) of the current Standard is unclear and that that for sake of efficiency it should encourage the use of standard test procedures.

Advice on augmentations

It was suggested that due to the changing nature of the power system, the requirements for advice on augmentations under the Standard need to be increased.

Testing environments

Some stakeholders have suggested that the Standard needs to require the provision of an appropriate testing environment for data links.

Questions

- What issues have arisen that would justify expanding the scope of testing specified in the Standard? If so, what increases in scope are required? What would be the implications of a change in testing scope?
- What are examples of testing requirements that are considered too onerous for new generators? Are there opportunities to make these requirements less onerous without materially reducing the effectiveness of the testing programme in demonstrating the necessary capabilities?
- What changes to the definition of an "upgrade" is required? What implications would such a change have?
- Should section 6.4(c) of the current Standard be amended to encourage use of standard test procedures?
- What issues have arisen that would justify expanding the scope of augmentations required to be advised under the Standard?

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- What issues have arisen that would justify the Standard specifying the provision of testing environments for data links? What implications for stakeholders would such a new requirement have?

3.1.15 Transitional Arrangements

Transitioning of increased requirements

A number of stakeholders have stated that any increased requirements in the Standard need to be transitioned to accommodate additional funding requirements to meet such increased requirements.

Questions

- In what circumstances would transitional provisions be justified for increased requirements in the Standard? If justified, what form of provisions would be needed and for how long?

3.2 Emerging Issues

3.2.1 Scope of Standard

New Sources of Data

AEMO NEM control centres currently use limited real time data from PMUs. In the near future the level of this real time data from PMUs and HSMs will greatly increase and requirements for the communication of these data types may need to be included within the Standard.

Some stakeholders noted that the Integrating Energy Storage Systems rule change[3] will enable Small Generation Aggregators (SGAs) to provide FCAS and that the Standard may need to accommodate this change.

Some stakeholders identified that the Scheduled Lite Visibility Model[4] to provide visibility to AEMO of the output in the form of five-minute data may be required by mid-2022 and this may need to be accommodated in the Standard.

It was also noted that the Scheduled Lite Dispatchability Model is expected in 2024-25 to enable distribution connected aggregated DER to participate in central dispatch.

Provision of real time data to participants

One stakeholder suggested that in the future there may be a requirement for AEMO to also provide real time data to participants beyond current control signals.

Data requirements of NSPs

Whilst provision of real time data to NSPs from Generators and others is not within the scope of the Standard, it remains part of the overall data communications process in the NEM. For instance even if, say, a generator was to provide real time data directly to AEMO, there may still be a requirement for the generator to provide data separately to its NSP.

[3] This rule change comes into effect in June 2024. Refer - https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem

[4] For further details refer Sect 3.4 of https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf

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Costs vs benefits of enhancements to the Standard

Enhancements to the Standard will bring benefits but also may result in increased costs to the industry and ultimately consumers. It is possible that costs may be disproportionate in the case of enhanced requirements for smaller participants. However the necessity for those requirements may increase as the relative numbers of smaller participants increase.

Questions

- Does the Standard need to cover PMU and HSM data? If so why and on what basis should the requirements be set (i.e. appropriate standards on which the requirements could be based)?
- Does the Standard need to cover SGAs? If so why and on what basis should the requirements be set?
- Are changes to Standard required now to accommodate the Scheduled Lite Visibility Model? If so, what changes are required?
- What future changes to the Standard are likely to be required to accommodate the Scheduled Lite Dispatchability Model
- Is it likely that future changes to the Standard will be required to also cover provision of real time data from AEMO to participants beyond current control signals?
- Regardless of provision of data to AEMO, does the Standard need to incorporate or reference requirements for generators and others to provide real time power system data to their NSPs?
- Are there any specific factors AEMO should take into account in assessing the costs and benefits of a proposed enhancement to the requirements of the Standard?

3.2.2 Architectural Requirements

The current architecture for NEM power system data communications is a hierarchical structure:

1. Embedded scheduled generator communicates to DNSP via DNSP SCADA system
2. DNSP transfers data to its TNSP via dedicated data communication links
3. Transmission connected generators communicates to TNSP via TNSP SCADA system
4. TNSP transfers data to AEMO via dedicated communication links.

In the near future, a growing number of embedded battery generation, aggregated DER and VPP connections will need to be accommodated. Some stakeholders believe that this will mean that the current data communications structure will be no longer be fit for purpose.

Questions

- What changes to the current NEM power system data communications structure are likely to be required? Are there different options for such changes?

3.2.3 Data Protocols

Alternative Protocols

Under the current architecture as described in Section Error! Reference source not found., the only communication protocol support for connection to AEMO is the ICCP protocol. If, as some stakeholders suggested above, a change in the data communications structure is required, then it may be necessary for the Standard to accommodate alternative protocols for connection to AEMO. This is because the ICCP protocol is designed for data communication between control centres and would not be suitable if a generating unit were to communicate directly with AEMO.

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Questions

- If generators and other participants were permitted to communicate directly with AEMO, then what types of data protocols would be preferred?
- If for cyber security and other reasons, only a single protocol could be accommodated in addition to secure ICCP, what criteria should AEMO use to determine the most suitable protocol?

4. SUMMARY OF MATTERS FOR CONSULTATION

In summary, AEMO seeks comment and feedback on the following matters identified in this Issues Paper:

Section	Issue raised	Questions
3.1.1	Data to be provided - Standard needs to be more definitive on the range of measurements that need to be provided as there is significant uncertainty as to what will actually be required for new connections.	Does the Standard need to be more specific on the range of data covered by the Standard? If so why and what level of detail is considered necessary?
3.1.1	Definition of power system data - with the growth of embedded generation and the need for AEMO to monitor power flows in distribution systems which impact on the security of the transmission network, this definition needs to be expanded.	Does the definition of power system data need to be extended? If so why and what would be a more appropriate definition?
3.1.1	Definition of Control Commands - this definition is inadequate as it does not cover the full range of control commands sent out from AEMO NEM Control Centres.	Does the definition of control commands need to be extended? If so why and what would be a more appropriate definition?
3.1.1	Definition of RCE and RME - this definition in no longer adequate in context of new technology for data acquisition.	Do the definitions of RCE and RME need to be extended? If so why and what would be a more appropriate definition?
3.1.1	Participants in the data communications process - the Standard in Section 1.1 does not include the full range of participants involved in the data communications process.	Other than the changes required to accommodate additional participant categories identified in clause 4.11.1 of the NER, does the Standard need to extend or specify other participants or sub-groups within a category. If so, how and why?
3.1.2	The requirements set under the Standard for different classes of data need to take into account the use of the data and its criticality.	Should requirements under the Standard be varied according to how critical the data is? If so, what criteria should be used to determine the requirements particular data needs to meet?
3.1.2	The standard is not consistent with more stringent requirements in some areas (e.g. Market Ancillary Service Specification).	Are there examples where AEMO has specified requirements beyond those set in the Standard, and how can any potential inconsistencies best be reconciled?

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Section	Issue raised	Questions
3.1.2	The standard seems to assume that all participants in the data communications process operate data centres.	Are there examples where the Standard has not kept pace with developments in data communications technology?
3.1.2	There is an opportunity to design vulnerability out and design security in, as opposed to putting in place processes to manage the emergence of security issues. It might be possible for the Standard to encourage enhancement of resilience through design.	Is there an opportunity for the standard to encourage enhancement of resilience through design? If so, how might this be done?
3.1.2	The Standard to be clear on the consequences for a participant failing to meet the requirements of the Standard.	Should the Standard set out the consequences for a participant failing to meet its requirements?
3.1.3	The requirements specified for DNSPs may be unclear in a number of areas. Possible examples are: • Current standard does not reflect topology that applies for DNSP (e.g. diagram in Section 1.3 and tables 4 and 5). • Standard needs to state whether or not DNSP can have direct connection with AEMO rather than going through TNSP • Standard needs to account for diversity in comms between TNSP/DNSP to AEMO. • Standard should include situation where there are two intervening facilities and perhaps more.	What changes to the current Standard are required to clarify the requirements for DNSPs?
3.1.3	The current structure is making it difficult for new connections.	Are there specific examples where the current data communications structure is making it difficult for new connections or embedded participants? If so what changes in the Standard would be required to address these issues?
3.1.3	It is reported that wholesale demand response providers are finding it very difficult to be connected for data communications under current arrangements.	What difficulties are wholesale demand response providers finding to be connected for data communications under current arrangements?
3.1.3	New embedded scheduled and semi-scheduled generators have obligations under the rules and Generator Performance Standards (GPS) to participate in Automatic Generation Control (AGC). However, some stakeholders have indicated that this is not possible through some DNSP SCADA systems.	What difficulties do DNSPs have in communicating AGC control signals?

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Section	Issue raised	Questions
3.1.4	The current standard specifies ICCP IEC60870-6 TASE.2 and its extensions as a secure ICCP protocol. A stakeholder has questioned whether this can actually be considered as a secure protocol	Is the current ICCP Protocol specified in the current Standard still appropriate?
3.1.4	The Standard in Section 5.1 should be more specific on protocols used when AEMO WAN is connected to another party's data Communications Facility	What protocols should apply for connections to AEMO WAM?
3.1.5	The Standard should provide more clarity on the boundary of both operational and financial responsibility between · Generator and NSP · DNSP and TNSP · AEMO and TNSP	What additional detail is required in the Standard to provide more clarity on boundary of both operational and financial responsibilities?
3.1.5	The standard should make clear the obligation of parties to work together to resolve any problems to ensure a requirement is met.	Should an obligation for parties to work together be added to the Standard?
3.1.5	The Standard needs to be clear that connections are required to both AEMO control room sites.	Does the Standard need to clarify that connection is required to both AEMO control room sites?
3.1.6	The Standard needs a specific requirement that data sent is of good quality. It is possible for a connection to be available and the data to be unusable due to quality.	Should the Standard include a specific requirement that data sent should be of good quality? If so, what would be implications for stakeholders?
3.1.6	Some remote metering equipment does not provide quality flags.	Should all data be sent with quality flags? If so, what would be implications for stakeholders?
3.1.7	The Standard does not have an effective requirement to ensure the accuracy of data in particular to ensure that RME remains calibrated. Monitoring and remediation may be problematic (e.g. kv measurements at some stations can vary by over 10kV).	Should the Standard include a more specific requirement regarding data accuracy? If so, what would be implications for stakeholders?
3.1.7	All semi-scheduled units being clamped in SCADA (at the AEMO end) such that telemetered MW values could not be negative is undesirable, noting that participants are responsible for providing accurate data and separate metering of auxiliary loads.	How material is the issue regarding clamping of values for semi-scheduled units? If the standard were to be changed as suggested, what would be the implications for participants?
3.1.8	The Standard is not clear on requirements for data latency or end-to-end response times. There is current no minimum requirement for data latency.	Should the Standard include a specific requirement regarding data latency? If so, what would be implications for stakeholders?

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Section	Issue raised	Questions
3.1.8	Significant timing difference can exist particularly for the RME equipment that uses UTC time and the conversion of this to AEST. There should be greater clarity on the requirements for calibration, testing, validation, and maintenance of the timing stamp quality.	How material is the issue regarding timing differences due to RME? If the standard were to be changed to address this, what would be the implications for participants?
3.1.8	Monitoring end-to end update times is difficult post commissioning	Should an additional requirement be included in the Standard to allow ongoing monitoring of end-to-end response times? If so, what would be the implications of such a change?
3.1.9	AGC is showing performance issues which suggest that a more responsive control loop is needed. With the current 4 second AGC cycle, updates at a minimum of less than 2 seconds may be required. There have been incidents where AGC used to control a battery is stale (20s old) resulting in unwarranted discharge and charge cycles and at times oscillations. This is mainly because the communications delay is more than 97% of the response delay time.	What would the implications be if the specification of maximum delay for control commands was tightened to 2 seconds? What are the implications if control command delays remain at current levels?
3.1.9	There should be increased use of dispatch signals via SCADA through the NSP as AEMO's Market Portal may be unreliable and any failure to meet dispatch requirement increases system risk.	Is there a material issue associated with reliability of the connection to AEMO's market portal?
3.1.9	The specification of maximum delays may not adequately take into account the number of intervening facilities through which the command signal needs to be relayed.	Should the specification of control command delays in the Standard take into account the number of intervening facilities? If so, how should these be accounted for and what would the implications be?
3.1.10	The current standard is not clear on obligations of the parties to the security of the data (physical, personnel and cyber) and of control protocols at the level required for critical infrastructure.	What specific obligations regarding maintenance of security should be included in the Standard, and what would be the implications of this?
3.1.10	Alignment between this data communications standard and these current and proposed regulations requires consideration.	Does the legislation adequately cover security obligations and requirements or is there a need for more detailed obligations in the Standard?
3.1.10	The Standard should include an obligation for participants to advise AEMO of any known relevant cyber security issues or when abnormal risks to cyber security arise.	What would be the implications of including a specific obligation to advise on cyber security risks?

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Section	Issue raised	Questions
3.1.10	There are questions about ownership and control and rights to data, and when. While not specifically related to the Standard, the standard should nonetheless fully support and enable these requirements.	Should the Standard be enhanced to better identify and support the protection of the confidentiality of data? If so what type of enhancement is required?
3.1.11	There is a need for greater clarity in Section 3.1 of the Standard regarding the specification of reliability requirements. In particular: • In table 4 standard term RCE needs to be better defined • Tables 4 and 5 are not clear. For instance does the 6 hour requirement apply to a single site or all sites? • Possible inconsistency between table 4 and 5 • Difficulty in seeing how tables 4 and 5 apply to DNSPs • Need to better define what is meant by a critical outage in Section 3.1 - i.e. does it refer to total loss of data or simply loss of redundant path?	What changes would be required to clarify reliability requirements in the Standard?
3.1.11	The Standard should set expectations on the level of monitoring and reporting of reliability required. For instance, this might include a comprehensive heartbeat facility.	Does the Standard need to set enhanced expectations regarding monitoring and reporting of availability and why? What would be reasonable expectations to set? What changes would be required to data communications systems to achieve enhanced monitoring and reporting of availability?
3.1.11	Frequent and rapid applications of software patches is becoming an increasing requirement for maintaining cyber security. One stakeholder has queried whether new or additional redundancy may be needed at DCFs to allow rapid application of patches without disrupting operations.	Does any lack of redundancy currently restrict the ability of participants to apply software security patches in a timely manner?
3.1.12	Section 2.2 of the current Standard states that "DCPs must notify AEMO of their sign convention when applying to AEMO for registration as a Registered Participant. To change the sign convention, DCPs must give 60 business days' notice to AEMO". It is not clear whether this requirement applies to small scale changes to correct individual sign conventions or only to a major change following a change in policy.	What change to Section 2.2 of the Standard would be required to clarify the requirement for adequate notice?

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Section	Issue raised	Questions
3.1.13	The Standard has no specific requirements for the times required to return to service following forced outages and in practice failed data can take a long time to rectify. Tables 4 and 5 of the current Standard refer to a reliability requirement rather than a specific response time.	What issues have arisen that would justify including in the Standard a specific requirement regarding response time to forced outages? If so, what would reasonable expectations be?
3.1.14	The current testing scope does not include testing of whether the data is correct, but only that data is being communicated. The scope of testing specified under the Standard could also include testing for cyber security; and robust RCE and RME testing, calibration and validation.	What issues have arisen that would justify expanding the scope of testing specified in the Standard? If so, what increases in scope are required? What would be the implications of a change in testing scope?
3.1.14	The level of testing required for new generators is onerous.	What are examples of testing requirements that are considered too onerous for new generators? Are there opportunities to make these requirements less onerous without materially reducing the effectiveness of the testing programme in demonstrating the necessary capabilities?
3.1.14	Section 6.4 of the current Standard is not clear on what constitutes an "upgrade".	What changes to the definition of an "upgrade" is required? What implications would such a change have?
3.1.14	The requirement under Section 6.4(c) of the current Standard is unclear and that for the sake of efficiency it should encourage the use of standard test procedures.	Should section 6.4(c) of the current Standard be amended to encourage use of standard test procedures?
3.1.14	Due to the changing nature of the power system the requirements for advice on augmentations under the Standard need to be increased.	What issues have arisen that would justify expanding the scope of augmentations required to be advised under the Standard?
3.1.14	The Standard needs to require the provision of an appropriate testing environment for data links.	What issues have arisen that would justify the Standard specifying the provision of testing environments for data links? What implications for stakeholders would such a new requirement have?
3.1.15	Any increased requirements in the Standard need to be transitioned to accommodate additional funding requirements to meet such increased requirements.	In what circumstances would transitional provisions be justified for increased requirements in the Standard? If justified, what form of provisions would be needed and for how long?
3.2.1	AEMO NEM Control Centres currently use limited real time data from PMUs. In the near future the level of this real time data from PMUs and High-Speed Monitors (HSMs) will greatly increase and requirements for the communication of these data types may need to be included within the Standard.	Does the Standard need to cover to cover PMU and HSM data? If so why and on what basis should the requirements be set (i.e. appropriate standards on which the requirements could be based)?

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Section	Issue raised	Questions
3.2.1	Some stakeholders have noted that the Integrating Energy Storage Systems rule change will enable Small Generation Aggregators (SGAs) to provide FCAS and that the Standard may need to accommodate this change	Does the Standard need to cover SGAs? If so why and on what basis should the requirements be set?
3.2.1	The Scheduled Lite Visibility Model to provide visibility to AEMO of the output in the form of five-minute data may be required by mid-2022 and this may need to be accommodated in the Standard.	Are changes to Standard required now to accommodate the first stage of the Scheduled Lite Project? If so, what changes are required?
3.2.1	The Scheduled Lite Dispatchability Model is expected in 2024-25 to enable distribution connected aggregated DER to participate in central dispatch.	What future changes to the Standard are likely to be required to accommodate the second stage of the Scheduled Lite Project?
3.2.1	In the future there may be a requirement for AEMO to also provide real time data to participants.	Is it likely that future changes to the Standard will be required to also cover provision of real time data from AEMO to participants?
3.2.1	Whilst provision of real time to NSPs from Generators and others is not within the scope of the Standard, it remains part of the overall data communications process in the NEM. For instance even if, say, a generator was to provide real time data directly to AEMO, there may still be a requirement for the generator to provide data separately to its NSP.	Regardless of provision of data to AEMO, does the Standard need to incorporate or reference requirements for generators and others to provide real time power system data to their NSPs?
3.2.1	Enhancements to the Standard will bring benefits but also may result in increased costs to the industry and ultimately consumers. It is possible that costs may be disproportionate in the case of enhanced requirements for smaller participants, however the necessity for those requirements may increase as the relative numbers of smaller participants increase.	Are there any specific factors AEMO should take into account in assessing the costs and benefits of a proposed enhancement to the requirements of the Standard?
3.2.2	In the near future, a growing number of embedded battery generation, aggregated DER and VPP connections will need to be accommodated. Some stakeholders believe that this will mean that the current data communications structure will be no longer fit for purpose.	What changes to the current NEM power system data communications structure are likely to be required? Are there different options for such changes?

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Section	Issue raised	Questions
3.2.3	Under the current architecture as described in Section 3.2.2, the only communication protocol support for connection to AEMO is the ICCP protocol. If a change in the data communications structure is required, then it may be necessary for the Standard to accommodate alternative protocols for connection to AEMO. The ICCP protocol is designed for data communication between control centres and would not be suitable if a generating unit were to communicate directly with AEMO.	If generators and other participants were permitted to communicate directly with AEMO, then what types of data protocols would be preferred? If for cyber security and other reasons, only a single protocol can be accommodated in addition to secure ICCP, what criteria should AEMO use to determine the most suitable protocol?

5. NEXT STEPS

Submissions on this Issues Paper must be made in accordance with the Notice of First Stage of Consultation published with this paper by 5.00 pm AEDT on 15 March 2022 to email address Data.Comms@aemo.com.au

AEMO is seeking feedback in particular on the materiality and impact of the issues identified in this Issues Paper, and any proposed solutions, options, or impediments for change. AEMO requests that the expected costs and benefits of any proposed solution are identified in submissions to the extent possible. Respondents may also wish to identify any further issues that they believe should be considered in AEMO's review of the Standard.

Following consideration of the responses to this Issues Paper, AEMO will prepare and publish a draft report together with a draft of proposed amendments to the Standard for further consultation, as described in section 1.

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APPENDIX A - GLOSSARY

Terms and acronyms used in this Issues Paper are largely defined in:

- the glossary of the NER[5] or
- the glossary of the existing Standard [6]

In addition a number of other terms and acronyms are used in this Paper as follows:

Term or acronym	Meaning
ACSC	Australian Cyber Security Centre
AESCSF	Australian Energy Sector Cyber Security Framework
AEDT	Australian Eastern Daylight Savings Time
AEST	Australian Eastern Standard Time
CB	Circuit Breaker
DLR	Dynamic Line Rating
DNSP	Distribution Network Service Provider
DTR	Dynamic Transformer Rating
GPS	Generator Performance Standards
HSM	High Speed Monitor
kV	Kilovolt
LOLS	Line Overload Load Shedding
PMU	Phasor Measurement Unit
QoS	Quality of Supply
RAS	Remedial Action Scheme
RPC	Reactive Plant Control
SCADA	Supervisory control and data acquisition
SGA	Small Generation Aggregator
SOCI	Security of Critical Infrastructure
SPS	Special Protection Scheme
TNSP	Transmission Network Service Provider
UTC	Co-ordinated Universal Time
WAN	Wide Area Network

[5] https://www.aemc.gov.au/sites/default/files/content//Chapter-10_-Glossary.PDF

[6] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/AEMO-Standard-for-Power-System-Data-Communications.pdf

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