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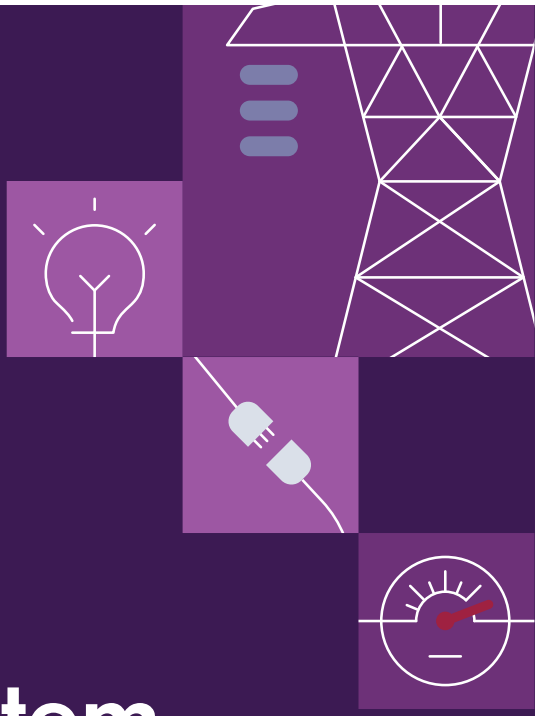

Review of Power System Data Communication Standard

Final Report and Determination

24 November 2022

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New South Wales | Queensland | South Australia | Victoria | Australian Capital Territory | Tasmania | Western Australia

Australian Energy Market Operator Ltd ABN 94 072 010 327

Executive summary

The publication of this Final Report and Determination (Final Report) concludes the Rules consultation process conducted by AEMO to consider amendments to the **Power System Data Communications Standard** (the Standard) under the National Electricity Rules (NER).

The Standard sets out the standards and protocols with which relevant registered participants, referred to as data communication providers (DCPs), must comply 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 AEMO control centres. The standard covers areas such as:

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

The Standard was last reviewed in 2017. AEMO undertook the 2022 review to consider:

- Issues arising with a number of aspects of the current Standard such as data accuracy, data latency and response to failures.
- Issues that are expected to emerge due to power system and market changes over the next two to three years.

Principles of decision-making – cost and benefit considerations

Any enhancements to the Standard should be expected to deliver benefits for the NEM, but also may result in increased costs to the industry and ultimately consumers. In this review, AEMO has recognised and sought to address the risk that the costs of improving standards could be disproportionately high for smaller participants, while also considering where enhancements could reduce barriers to entry, increase efficiency and reduce costs in the longer term.

AEMO's approach to this review and the conclusions in this Final Report are, therefore, underpinned by the guiding principles of the national electricity objective[1] and good electricity industry practice. The primary objective of changes to the Standard is to ensure effective support for acceptable power system security outcomes. For any proposed increase or change in the Standard requirements, AEMO has therefore considered:

- Where the current Standard falls short of good electricity industry practice for the NEM power system.
- The risks posed to power system security or resilience due to each of these gaps, both currently and expected in the medium term.
- A reasonable, efficient approach to address each of these gaps, having regard to technological feasibility and cost to the NEM, considering both immediate and longer terms costs and benefits.

[1] Section 7 of the National Electricity Law

In some cases, the Standard also needs to change to recognise or implement obligations already set, explicitly or implicitly, by the NER, an AEMO procedure or other legislation applicable to the industry or broader operations. In these cases, the Standard should not be seen as setting a new requirement.

Where implementation options are available, AEMO has endeavoured to allocate obligations under the Standard to the participants expected to be able to manage them most efficiently and recognise any associated benefits that may accrue to participants from different options (where those benefits are likely to be in consumers' long term interests).

Issues with the current Standard

AEMO and stakeholders identified several issues with aspects of the current Standard, largely through a pre-consultation exercise conducted in late 2021, to inform an issues paper[2] which commenced AEMO's formal consultation. The principal issues identified for consultation are summarised below, together with AEMO's final position on each of them.

Range of data to be provided

Some stakeholders suggested that the Standard needs to be more definitive on the range of measurements that need to be provided and indicated there is significant uncertainty on these requirements for new connections. AEMO has noted that the Standard cannot itself set specific obligations to provide data to AEMO; it can only refer to obligations set by other provisions in the NER or under instruments. In response to these submissions, AEMO will consider developing an industry guideline or resource for information on specific data requirements. In the Standard itself, AEMO has made amendments to clarify the general definitions in the Standard including the definition of power system data.

Participants covered by the Standard

It was noted that the Standard does not specify the full range of participants involved in the data communications process (e.g. participants providing inertia and system strength services; data from major industrial loads; virtual power plants and aggregated DER). Section 1.1 of the Standard has been amended to reflect recent NER changes in an inclusive manner, to cover all registered participants required under the NER to transmit and receive data to and from AEMO control centres in accordance with the Standard.

Consequences for a participant failing to meet the Standard

A stakeholder advocated for the Standard to be clear on the consequences for a participant failing to meet the requirements of the Standard. While the Standard cannot prescribe enforcement measures, AEMO has included examples of the measures which may be applied in the event of non-compliance, based on the NER and the broader regulatory framework. The Standard also recognises that cooperation between multiple parties may be required to achieve compliance.

Requirements for DNSPs

A number of submissions indicated that the requirements specified for distribution network service providers (DNSPs) in the current Standard are unclear, including:

- The topology that applies for a DNSP.

[2] Refer https://aemo.com.au/consultations/current-and-closed-consultations/review-of-power-system-data-communication-standard

- Whether a DNSP can have direct connection with AEMO rather than communicating data through a transmission network service provider (TNSP) facility.
- Diversity in communications between network service providers (NSPs) and between a TNSP or DNSP and AEMO.
- Specific requirements where there are two or more Intervening Facilities.

The Standard has been amended to clarify that, subject to appropriate transitional arrangements, DNSPs are required to provide the services of an Intervening Facility in respect of remote monitoring and control equipment for plant within their network, involving the collection of data and relaying of control commands.

The amended Standard allows a DNSP Intervening Facility to directly connect to AEMO control centres, noting that a direct connection might be necessary in some cases to meet the performance requirements in the Standard. A further option, if practically feasible and agreeable to all parties, is for a DNSP's Intervening Facility to connect directly to one AEMO control centre and connect to the other AEMO control centre via the TNSP intervening facility. This arrangement would have the advantage of enhancing resilience of the data communications network.

Difficulties for new connections especially embedded participants and Wholesale Demand Response Providers

Stakeholders observed that the current data communications structure causes difficulties for new connections. For example, while new embedded scheduled and semi-scheduled generators are obliged under the NER and generator performance standards (GPS) to have automatic generation control (AGC) capability, this may not be possible through some DNSP SCADA systems. It was also reported that wholesale demand response providers are finding it very difficult to meet current data communications requirements.

Amendments to the Standard to clarify that DNSPs will provide the services of an Intervening Facility for connections within their network should address the majority of these issues. In cases where a market participant (e.g. an aggregator) is required to transmit and receive data between its facilities and AEMO control centres but has no obligation to provide similar data to its NSP, the Standard will provide the option of a direct connection with the market participant's facility and both AEMO control centres. Where it is not practicable to utilise existing data communication facilities, a direct connection will be facilitated. These 'non-NSP' Intervening Facilities will generally need to meet the same Standard requirements applicable to NSP Intervening Facilities for reliability, availability, and security, but in limited circumstances conditional exceptions may be permitted. Exceptions will consider individual size and the significance of aggregate regional quantities for the relevant category of data or participant.

Data quality

Some stakeholders indicated that the Standard needs specific requirements and definitions for data quality. The Standard has been amended to add a definition of good quality to the Standard and to expand the definition of a critical outage to include the failure of a facility to provide data of good quality.

Data accuracy

Some stakeholders emphasised the need for the Standard to set clear expectations regarding accuracy of data. The Standard has been amended to add a data accuracy requirement and an obligation for DCPs to address any identified accuracy issues within a specified time. This new requirement will apply to all new data points but only to existing data points where AEMO identifies that the inaccuracy of a particular data point is creating operational issues.

Data latency and control command delays

The current Standard has no minimum requirements for data latency, which covers the time taken for data to be transmitted from the field to AEMO and from AEMO to the field. The current hierarchical architecture reflected in the Standard can mean extended delays in end-to-end transmission, in particular for embedded generation and storage. Poor data latency is creating significant issues for real time operational applications and other processes dependent upon analysis of real time data (e.g. the causer pays algorithm), and also for participants when receiving control signals from AEMO.

Current levels of potential data latency may have unacceptable impacts on power system security as the contribution of embedded resources increases. The amended Standard provides clearer requirements for data latency and control command delays based upon end-to-end times, without reference to the number of Intervening Facilities between AEMO and the RME/RCE. This may result in a reduction in the required maximum transmission times for some individual facilities.

The end-to-end transmission time for status indications in the dispatch data and power system data categories is tightened to 3 seconds in order to better ensure the accuracy of results of the State Estimator which are critical for power system security analysis. However the Standard allows for this requirement to be relaxed, on a case by case basis, for less critical status indications.

The amended Standard sets a requirement for the maximum control command delay such that control commands must be transmitted to the relevant RCE within two seconds (on an end-to-end time basis). AEMO's experience is that this requirement is already being achieved by most DCPs with the exception of a limited number of legacy systems. The Standard makes provision for exemption and transition plans for such legacy systems.

Cyber-security

Some stakeholders identified that there should be better alignment between the Standard and current or proposed legislation and regulations relating to cyber-security. The Standard has been amended to reference the Australian Energy Sector Cyber Security Framework and require DCPs to assess and maintain compliance with the relevant security profile (security profile 1) and to refer to relevant provisions of the NER that apply to incident reporting.

Reliability of connections

A number of issues were raised in relation to the reliability provisions of the Standard, with regard to data criticality, interfacing arrangements and the extent of communications failure. Amendments have been made to the Standard to address these issues. These include a requirement that all telemetry of operational data and transmission of commands to and from AEMO control centres, whether using an NSP's Intervening Facility or alternate telemetry options, will be capable of remaining operational for up to 10 hours following loss of external AC supply. There is a similar requirement for telemetry of data in the more critical categories between the individual remote monitoring and control equipment and Intervening Facilities. This requirement will also apply to the Intervening Facilities themselves.

Variations to these requirements may be considered for smaller participants connecting directly to AEMO in appropriate circumstances, subject to individual and regional significance.

Scope of testing

Stakeholders observed that the current testing scope does not cover testing for correctness of data (as distinct from its communication). The Standard has been amended to make it clear that the scope of testing should include testing for data correctness.

PMU and HSM data

It was suggested that the Standard should cover phasor measurement unit (PMU) and high speed monitoring (HSM) data if it is deemed integral to power system security. The Standard has been amended to include specific reference to PMU and HSM data in the Standard, where it is telemetered for real-time operational use as distinct to offline analysis. PMU and HSM data would be included in the definition of High-Resolution Data, but the Standard recognises that some requirements for PMU and HSM data will be separately determined.

Data protocols

Under the current architecture, the only communication protocol supported for connection to AEMO is the Inter-Control Center Communications Protocol (ICCP). If significant changes in the data communications structure are made, then the Standard may need to accommodate alternative protocols for connection to AEMO.

The amended Standard includes an option in the Standard for use of the DNP3 Secure Authentication protocol (versions of DNP3-SAv5 and above), in circumstances where the Standard allows for direct connection to AEMO control centres from non-NSP Intervening Facilities that are not suitable for the ICCP.

It is appreciated that additional protocols might become more effective and feasible for AEMO to support as they evolve. In the short to medium term, the Standard provides certainty for the use of a secure DNP3 protocol for relevant data connections. To facilitate ongoing adaptation, AEMO may also specify additional supported protocols in future, without requiring an amendment to the Standard itself.

Transitional provisions

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

AEMO has decided upon a process by which increased or additional requirements for existing data communications infrastructure may be implemented in accordance with a schedule agreed with AEMO, reflecting the implementation effort. To provide a level of certainty, the amended Standard sets out maximum implementation periods for DCPs as follows:

- for regulated NSPs, 12 months after the start of the next regulatory reset period after the amended Standard comes into effect; and
- for other DCPs, within 2 years after the amended Standard comes into effect unless the DCP is reliant on implementation of enhanced capabilities by an NSP. If this is the case, then the relevant DCP will be required to meet the increased requirement within 12 months of the commissioning of the necessary enhancements by the NSP.

Emerging Issues

Power system and market changes over the next two to three years are expected to result in additional emerging issues for power system data communications, which may require further consideration in the Standard. The identified issues, and AEMO's final positions on them, are summarised below.

Introduction of 'Scheduled Lite'

Some stakeholders identified that the Standard may need to accommodate the proposed Scheduled Lite reform. This initiative is being progressed to provide visibility to AEMO and the market of the output of distribution-connected aggregated DER and flexible demand, including small generation that is

currently non-scheduled, in the form of five-minute data. Scheduled Lite will also enable these types of resources to participate in central dispatch.

AEMO has amended the Standard to clarify the normal reliability requirements of an Intervening Facility in the Standard. The Standard also allows for AEMO to review and potentially approve certain telemetry planned to be provided with a lesser reliability, considering compliance with required cyber security measures and subject to aggregate limitations in each region.

Accommodating power system changes

As the power system continues to transform, data from a growing number of embedded battery generation, aggregated DER and virtual power plant connections will need to be accommodated. Some stakeholders suggested changes should be made to the Standard to recognise these needs, including direct communication paths to DNSP aggregation systems and clarity of communication paths for different types of participants and equipment.

AEMO has amended the Standard to facilitate changes in data communications architecture so that:

- It is clear that DNSP Intervening Facilities can connect directly to AEMO, with the option of having a secondary communication path via the Intervening Facility of its relevant TNSP where this practically feasible and agreeable to all parties.
- DNSP Intervening Facilities must have the capability to transfer control commands from AEMO to embedded participants connected to their networks (such as generating units and grid-level storage).

DCPs who are not required to provide data to an NSP may also connect directly to AEMO, if there is no practical opportunity to utilise existing data communication facilities. These non-NSP Intervening Facilities would be subject to appropriate protocols and communication paths, as described above.

AEMO considers that the changes in architecture represents a necessary and efficient change to accommodate embedded connections and aggregations in a way that can effectively address both data security and power system security needs in the medium term.

As the power system continues to evolve in the longer-term, the Standard will also need to evolve, as the nature of the changes, associated issues and potential solutions cannot yet be predicted at the level of detail required for the Standard. For this reason, AEMO is proposing to hold annual workshops to review the performance of the Standard and the need for further changes[3].

Determination

AEMO's determination is to amend the **Power System Data Communications Standard** in the form published with this Final Report. These amendments will have an effective date of 3 April 2023, with transitional provisions in place for some requirements requiring material equipment or system changes.

[3] A formal review of the Standard requires significant resources and thus, whilst the workshops are intended to be held annually, formal reviews are likely to be conducted no more frequently than every two years unless there are significant relevant reforms.

Contents

1. Stakeholder consultation process

As required by National Electricity Rules (NER) 4.11.2(c), AEMO has consulted on amendments to **the Power System Data Communications Standard** (Standard) in accordance with the 'rules consultation procedures' in rule 8.9 (NER version 184). As this consultation commenced prior to the effective date of the *National Electricity Amendment (Improving consultation procedures in the rules) Rule 2022*, it has been continued and concluded under the previous rules consultation procedures.

This Final Report uses several terms that are defined in the NER and in the existing Standard, which are intended to have the same meanings. There is a glossary of other terms and abbreviations at **Appendix A**.

AEMO's timeline for this consultation is outlined below.

Deliverable	Date
Notice of first stage consultation and Issues Paper published	3 February 2022
First stage submissions closed	15 March 2022
Draft Report & Notice of second stage consultation published	7 September 2022
Submissions due on Draft Report	7 October 2022
Final Report published	24 November 2022

AEMO's issues paper outlined a series of issues with the current Standard which had been identified by AEMO and by stakeholders through an extensive pre-engagement exercise, as described in the issues paper. The issues paper also noted that AEMO was extending this consultation beyond Network Service Providers (NSPs) to all registered participants and interested parties, as the requirements in the Standard affect the obligations of registered generators, some customers, demand response service providers, and the providers of ancillary services and other system security services.

AEMO received 10 written submissions on its issues paper and held one confidential meeting requested by a stakeholder in March 2022. The participants who made written submissions were AGL, CIGRE Australia, CS Energy, Delta Electricity, ElectraNet, Enel X, Energy Queensland, Hydro Tasmania, Powerlink, and SA Water.

AEMO's Draft Report was published on 7 September 2022.

AEMO received six written six written submissions on the Draft Report (including one late submission, which was accepted). The participants who made written submissions were CS Energy, Delta Electricity, Energy Queensland, Hydro Tasmania, Ausgrid and TasNetworks.

All AEMO reports and written submissions (excluding any confidential information) have been published on AEMO's website at: https://aemo.com.au/consultations/current-and-closed-consultations/review-of-power-system-data-communication-standard.

2. Background

2.1. NER requirements

The Standard is made under clause 4.11.2(c) of the 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 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:

- NSPs under clause 4.11.2(a) of the NER;
- Generators under clauses 4.11.1(a) and S5.2.6 of the NER, subject to relevant conditions of their performance standards;
- 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;
- 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;
- Providers of ancillary services, system strength and inertia services under clause 4.11.1(b) of the NER;
- Demand Response Service Providers (DRSPs) under clause 4.11.1(c1) of the NER.

2.2. Context for this consultation

AEMO 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 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.

The issues with the current Standard that AEMO identified for consultation related to:

- The need for more responsive control loops in AEMO's Automatic Generation Control (AGC) system.
- Data latency, with data in some cases being tens of seconds old before being received by AEMO.
- Lack of specificity in requirements regarding data quality accuracy and reliability.
- The need to 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.
- Lack of specific requirement to resolve issues with data communications.

Looking to the future, AEMO was 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 as a result of the ongoing power system transition and reforms. 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 proposed Scheduled Lite reform may also occur in this timeframe.

The impact of these changes on NEM data communications requirements going forward was therefore a key part of AEMO's review, in particular considering:

- 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.

AEMO recognised that it may not be possible to address every issue (particularly for future development) in the next version of the Standard, however, where a need was established through this review AEMO's intent was to identify a process to address that need in a timely manner where feasible.

3. List of material issues

Based on the material issues identified for the issues paper, AEMO identified 54 discrete questions on which feedback was invited for the Draft Report, noting that there is a degree of overlap between some of them. A further five issues were identified from submissions.

These 59 questions are listed in the following table and were discussed in section 4 of the Draft Report

No.	Issue	Raised by
1	Does the Standard need to be more specific on the range of data it covers?	In Issues Paper
2	Does the definition of power system data need to be extended?	In Issues Paper
3	Does the definition of control commands need to be extended?	In Issues Paper
4	Do the definitions of RCE and RME need to be extended?	In Issues Paper
5	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 subgroups within a category?	In Issues Paper
6	Should requirements under the Standard be varied according to how critical the data is?	In Issues Paper
7	Are there examples where AEMO has specified requirements beyond those set in the Standard?	In Issues Paper
8	Are there examples where the Standard has not kept pace with developments in data communications technology?	In Issues Paper
9	Is there an opportunity for the Standard to encourage enhancement of resilience through design?	In Issues Paper
10	Should the Standard set out the consequences for a participant failing to meet its requirements?	In Issues Paper
11	What changes to the current Standard are required to clarify the requirements for DNSPs?	In Issues Paper
12	Are there specific examples where the current data communications structure is making it difficult for new connections or embedded participants?	In Issues Paper
13	What difficulties are wholesale demand response providers finding when connecting for data communications under the current arrangements?	In Issues Paper
14	What difficulties do DNSPs have in communicating AGC control signals?	In Issues Paper
15	Is the current secure ICCP specified in the current Standard still appropriate?	In Issues Paper
16	What protocols should apply for connections to AEMO WAN?	In Issues Paper
17	What additional detail is required in the Standard to provide more clarity on the boundary of both operational and financial responsibilities?	In Issues Paper
18	Should an obligation for parties to work together be added to the Standard?	In Issues Paper
19	Does the Standard need to clarify that connection is required to both AEMO control room sites?	In Issues Paper
20	Should the Standard include a specific requirement that data sent should be of good quality?	In Issues Paper
21	Should all data be sent with quality flags?	In Issues Paper
22	Should the Standard include a more specific requirement regarding data accuracy?	In Issues Paper
23	How material is the issue regarding clamping of values for semi-scheduled units?	In Issues Paper
24	Should the Standard include a specific requirement regarding data latency?	In Issues Paper
25	How material is the issue regarding timing differences due to RME?	In Issues Paper
26	Should an additional requirement be included in the Standard to allow ongoing monitoring of end-to-end response times?	In Issues Paper
27	What would the implications be if the specification of maximum delay for control commands was tightened to 2 seconds?	In Issues Paper

No.	Issue	Raised by
28	How material is the issue of unreliability of connection to AEMO's market portal?	In Issues Paper
29	Should the specification of control command delays in the Standard take into account the number of Intervening Facilities?	In Issues Paper
30	What specific obligations regarding maintenance of security should be included in the Standard?	In Issues Paper
31	Does the legislation adequately cover security obligations and requirements or is there a need for more detailed obligations in the Standard?	In Issues Paper
32	What would be the implications of including a specific obligation for DCPs to advise on cyber security risks?	In Issues Paper
33	Should the Standard be enhanced to better identify and support the protection of the confidentiality of data?	In Issues Paper
34	What changes would be required to clarify reliability requirements in the Standard?	In Issues Paper
35	Does the Standard need to set enhanced expectations regarding monitoring and reporting of availability?	In Issues Paper
36	Does any lack of redundancy currently restrict the ability of participants to apply software security patches in a timely manner?	In Issues Paper
37	What change to section 2.2 of the Standard would be required to clarify the requirement for adequate notice?	In Issues Paper
38	What issues have arisen that would justify including in the Standard a specific requirement regarding response time to forced outages?	In Issues Paper
39	What issues have arisen that would justify expanding the scope of testing specified in the Standard?	In Issues Paper
40	What are examples of testing requirements that are considered too onerous for new generators?	In Issues Paper
41	What changes to the definition of an "upgrade" are required?	In Issues Paper
42	Should section 6.4(c) of the current Standard be amended to encourage use of standard test procedures?	In Issues Paper
43	What issues have arisen that would justify expanding the scope of augmentations required to be advised under the Standard?	In Issues Paper
44	What issues have arisen that would justify the Standard specifying the provision of testing environments for data links?	In Issues Paper
45	In what circumstances would transitional provisions be justified for increased requirements in the Standard?	In Issues Paper
46	Does the Standard need to cover PMU and HSM data?	In Issues Paper
47	Does the Standard need to cover SGAs?	In Issues Paper
48	Are changes to Standard required now to accommodate the Scheduled Lite Visibility Model, or future changes to accommodate the Scheduled Lite Dispatchability Model?	In Issues Paper
49	Is it likely that future changes to the Standard will be required to cover provision of real time data from AEMO to participants beyond current control signals?	In Issues Paper
50	Does the Standard need to incorporate or reference requirements for generators and others to provide real time power system data to their NSPs?	In Issues Paper
51	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?	In Issues Paper
52	What changes to the current NEM power system data communications structure are likely to be required?	In Issues Paper
53	If generators and other participants were permitted to communicate directly with AEMO, what types of data protocols would be preferred?	In Issues Paper
54	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?	In Issues Paper

No.	Issue	Raised by
55	Definition of analogue value	Energy Queensland
56	Data quality	Hydro Tasmania
57	Review of Standard	Hydro Tasmania
58	Data for power system modelling	ElectraNet
59	Specific NSP obligations	SA Water

The submissions on the Draft Report raised 25 substantive issues on aspects of the proposed draft Standard and one new issue. These issues are listed in the following table and discussed in Section 4 of this Final Report.

No.	Issue	Raised by
1	Definition of Operational Data / Application of Standard to High Resolution Data	Energy Queensland
2	Definition of Primary System Security Data	Energy Queensland
3	Problem with term “Secondary System Security Data”	Energy Queensland
4	Definition of High Resolution Data	Energy Queensland
5	Definition of Secure Private Network	Energy Queensland
6	HSM & PMU data and ICCP Protocol	Energy Queensland
7	Inability to transmit controls over ICCP links in series	Energy Queensland
8	Need for further details in Fig1 in section 1.5	Energy Queensland
9	Need for clarity regarding quality flags	Energy Queensland
10	Concerns regarding reduction in maximum delay times for status indications	Energy Queensland
11	Concerns regarding new requirements re data accuracy	Energy Queensland
12	Concerns regarding scope of data security issues required to be advised to AEMO	Energy Queensland
13	Concerns regarding need for encryption of data between RME/RCE and IF	Energy Queensland
14	Use of term “testing” in reference to checking NSP data against AEMO data	Energy Queensland
15	Will AEMO provide a template for reporting?	Energy Queensland
16	Specification of requirements for HSM and PMU devices	Energy Queensland
17	What are the enforcement actions if a non-compliance occurs within an IF?	Energy Queensland
18	Inconsistency in nomination of effective date for the Standard	Energy Queensland
19	The maximum time allowed to complete transitional processes is inadequate	Energy Queensland
20	Need to specify configurations that would provide compliance	Ausgrid
21	Proposal to improve fault management co-ordination	Delta Electricity
22	Issues with information on AGC settings	Delta Electricity
23	Need for ongoing communication on need for transitional arrangements and earlier effective date	Hydro Tasmania
24	Application of transitional arrangements to meet increased security requirements	TasNetworks
25	Concerns re application of IEC 62351 to communications between RME/RCE and IFs	TasNetworks
26	Query regarding situation where action to address an increased requirement will require action by multiple DCPs	TasNetworks

A detailed summary of views expressed, and issues raised in submissions on the Draft Report, together with AEMO’s responses, is contained in **Appendix B** of this Final Report.

4. Discussion of material issues

This section describes the material issues raised in submissions to the Draft Report, including the views expressed in stakeholder submissions, and AEMO's analysis and conclusion on the issue. Any resulting amendments to the draft version of the Standard published with the Draft Report are reflected in the final version of the Standard published with this Final Report.

4.1. Glossary Definitions (Section 1.2 of Standard)

4.1.1. Issue summary and submissions

Energy Queensland raised a number of issues regarding the glossary definitions in section 1.2 of the draft Standard as follows:

- Operational Data – The definition of "Operational Data" previously captured all four types of data listed below. However, reference is made to "Operational Data" in some sections (for example, section 5.2.1) which excludes High Resolution Data. Therefore, it is recommended that "High Resolution Data" is removed from the definition of "Operational Data" to avoid confusion.
- Primary System Security Data – It is unclear why the "'at least 220kV" reference is included. It is our understanding that 132kV would be the minimum level of interest, given the transmission network includes voltages at that level.
- Secondary System Security Data - To a Network Service Provider (NSP), "Secondary System" refers to devices such as protection relays, remote terminal units and tap changers, i.e. items that control / monitor primary plant. The use of the term "Secondary System" may therefore result in confusion.
- High Resolution Data – It is suggested that "'a typical sample rate of 20 millisecond intervals" should be replaced by "'50 samples per second" to provide greater clarity. In addition, the definition is limited to devices with GPS clock synchronisation, whereas there are multiple time sources available that can achieve the required accuracy. It is therefore suggested that a timestamp resolution requirement should instead be included in the definition, such as "microsecond accuracy" (preferably no tighter tolerance than is actually required).
- Secure Private Network – The requirements set out in section 5.1(d) suggest that "Secure Private Network" is intended to exclude any public carrier network. However, the current wording for this definition could be interpreted to also include Virtual Private Networks or other end-to-end encrypted communication paths over public or multi-user commercial telecommunications infrastructure. In refining this definition, care should also be taken to not exclude standard aggregation of telecommunications channels (PDH, SDH, MPLS, etc.) that will occur on any communications network of significant size.

4.1.2. AEMO's assessment

Operational Data

AEMO's view is that high resolution data is Operational Data. The manner of specification of PMU and HSM data is different to that for other forms of Operational Data and so needs to be treated differently in the Standard. Section 1.7 of the draft Standard sets out these differences. However, AEMO is keen to avoid any potential confusion and will make further amendments where appropriate so that it is clear

whether or not each set of Operational Data obligations in the Standard applies to high resolution data from PMUs and HSMs.

Primary System Security Data

AEMO agrees that the definition of Primary System Security Data should be consistent with the extent of a transmission network as defined in the NER:

> *A network within any participating jurisdiction operating at nominal voltages of 220kV and above plus:*
>
> *(a) any part of a network operating at nominal voltages between 66 kV and 220 kV that operates in parallel to and provides support to the higher voltage transmission network;*
>
> *(b) any part of a network operating at nominal voltages between 66kV and 220 kV that is not referred to in paragraph (a) but is deemed by the AER to be part of the transmission network.*
>
> *Except in the case of a declared transmission system of an adoptive jurisdiction, an identified user shared asset and designated network asset owned, controlled or operated by a Primary Transmission Network Service Provider (including a third party IUSA or designated network asset not owned by the Primary Transmission Network Service Provider that is the subject of a network operating agreement) forms part of that Primary Transmission Network Service Provider's transmission network.*

Secondary System Security Data

AEMO acknowledges the current name of this term has the potential to create confusion with terminology commonly used to refer to other concepts. AEMO will change the name of the term to “System Security Secondary Data” and make a corresponding change for Primary System Security Data for consistency.

High Resolution Data

Regarding the suggestion to change to 50 samples per second, AEMO considers the reference to “'a typical sample rate of 20 millisecond intervals” should remain as it was desirable to have samples evenly distributed. For instance there might be a situation where 50 samples are transmitted over a half second period and then no samples over the next half second period. This would still satisfy a requirement for 50 samples per second.

Regarding the concern that the current definition limits devices to those with GPS clock synchronisation, AEMO agrees that the definition can be less prescriptive as to the method, provided that the device is able to achieve an equivalent outcome to what is currently achieved through GPS clock synchronisation.

Secure Private Network

To avoid confusion, AEMO has amended the Standard to clarify that there are separate requirements for security of communication (via a private network not accessible by third parties) and resilience (with a 10 hour back-up power supply). The necessary resilience to meet the default standard cannot be achieved using the public internet, irrespective of security protocols. Where exceptions are granted, they apply to the resilience criterion only, and a secured service is still required.

4.1.3. AEMO's conclusion

Operational Data

High resolution data from PMUs and HSMs for real time operational purposes will still be included in the definition of Operational Data, but the definition calls out that references to Operational Data can specifically exclude some categories. For the sake of clarity, AEMO has made further amendments such that where Operational Data is referred to in Standard, it is clear whether or not the relevant obligations extend to high resolution data provided by PMUs and HSMs. AEMO has made an additional change from the draft Standard in that section 8 may be applicable to PMU and HSM data, to the extent that relevant NER obligations apply.

Primary and Secondary System Security Data

The defined terms are amended to System Security Primary Data and System Security Secondary Data respectively. Further, System Security Primary Data will be defined by reference to transmission network and dual function assets, with no 220 kV threshold.

High Resolution Data

The definition of high resolution data will be amended to confirm that devices transmitting high resolution data may use equivalent technology to GPS clock synchronisation. Additional clarifications will be made to ensure that, if high resolution data is required for dispatch, the obligations relating to dispatch data will apply.

Secure Private Network

The Standard has been amended to specify separate requirements for a:

- 'Secure Network', defined as a private network not accessible by third parties and meeting the cyber-security requirements in section 4.4.2(b) to (d) of the Standard.
- 'Resilient Network', which conveys the requirement for at least 10 hours' back-up power supply.

Where exceptions are granted under section 5.1, the Standard specifies that they apply only to the requirement for a Resilient Network.

4.2. NSP Obligations (Section 1.4 of Standard)

4.2.1. Issue summary and submissions

Energy Queensland raised two concerns regarding the ability to comply with section 1.4 of the draft Standard:

- Under 1.4.1(a), Energy Queensland understands that HSM and PMU data collected by the NSP will not be able to transmit the microsecond accuracy timestamp required via the ICCP protocol.
- Under 1.4.1(b)(iii) - Energy Queensland understands that there is no way to transmit controls across more than one ICCP link in series without customer application software or customer DMS / EMS logic, and therefore, the secondary option of the DNSP going via the TNSP is not suitable for controls unless an alternative protocol, such as DNP3, is used between the DNSP and TNSP.

4.2.2. AEMO's assessment

With regard to section 1.4.1(a) of the draft Standard, AEMO is not requiring that high resolution PMU data be transmitted by ICCP. Section 1.7 of the draft Standard has sought to make this clear, but further changes will be made for additional clarity as described in Section 4.1.3 above, in the discussion on Operational Data.

It should be noted that PMU devices can provide both high resolution data and low resolution data. This distinction needs to be recognised in the Standard as the slower speed data could be used as input to a traditional RME and SCADA system.

With regard to section 1.4.1(b)(iii) of the draft Standard, AEMO is not proposing that controls be transferred under this option through ICCP links in series but rather through the TNSP intervening facility using application software. Section 1.4.1(b)(iii) will be clarified accordingly.

4.2.3. AEMO's conclusion

The issue raised by Energy Queensland on section 1.4.1(a) of the draft Standard is addressed by amendments to clarify whether obligations relating to Operational Data in the Standard extend to high resolution data provided by PMUs and HSMs.

AEMO has amended section 1.4.1(b)(iii) to include a specific statement that the TNSP's Intervening Facility will retransmit the relevant Operational Data to and from AEMO.

4.3. Overview of Data Communications Facilities (Section 1.5 of Standard)

4.3.1. Issue summary and submissions

Energy Queensland commented that Figure 1 in the Standard (General Structure of DCF) does not reflect the option as outlined in section 1.4.1(b)(i) for a DNSP (Intervening Facility 2) having direct connections to each of the AEMO control centres.

4.3.2. AEMO's assessment

AEMO agrees that Figure 1 does not reflect allowable configurations as clearly as it could, and will revise it to improve clarity,

4.3.3. AEMO's conclusion

Figure 1 (General Structure of DCF) has been revised, with additional explanation in the description of the figure.

4.4. Representation of Data (Section 2.2 of Standard)

4.4.1. Issue summary and submissions

Energy Queensland has commented regarding section 2.2(f) of the Standard that further clarity is required as to the meaning of "default state must be set to good".

4.4.2. AEMO's assessment

The two adverse states to be indicated by a quality flag are set out in section 2.2(f)(i) and (ii) of the Standard, being a sustained communication failure or overriding of a value. If neither of these states is

present the quality flag should always indicate that data quality is good. AEMO will make minor drafting changes to further clarify the requirement.

4.4.3. AEMO's conclusion

AEMO has amended clause 2.2(f) of the Standard to clarify that the quality flag must indicate that the data is good when neither of the conditions in sub-paragraphs (i) and (ii) apply.

4.5. Age of Data (Section 2.3 of Standard)

4.5.1. Issue summary and submissions

Energy Queensland noted that the maximum times for the status indications for Dispatch Data and Primary System Security Data in Table 2 (End to End Time for data to be available for transmission to AEMO) are significantly lower than the previous Standard. Energy Queensland said it was not clear that these times are practical, and this would need to be tested, although this may not be an issue if they were to move to a direct connection to AEMO rather than via the TNSP.

4.5.2. AEMO's assessment

AEMO believes the draft proposal for maximum age of status data in the categories of dispatch data and system security primary data (3 seconds) is justified for most status indications in these categories. In assessing this AEMO considered the risks posed by the current requirements, the risk reduction that could be achieved by the proposed change and possible alternatives to address the risk. The outcome of this assessment is summarised below.

The risks posed to power system security or resilience due to longer transmission times, both currently and expected in the medium term. These risks have been assessed as follows:

- Consequence **–** The State Estimator does not correct the topology. It assumes it is correct. If the values are materially out of date, the result will be a valid but incorrect solution. The potential consequences of incorrect topology are either:
  - An incorrect but valid solution – this can lead to incorrect security assessment results in power system security monitoring tools such as CA, DSA, VSAT and VDS . Some of these tools run on a longer cycle. DSA runs at 420 second intervals, VSAT 300 seconds and VDS 600 seconds, so an incorrect security assessment can remain for some time before corrected by a rerun.
  - The State Estimator fails to solve – this means no security assessment is performed and any immediate action or response that may be necessary is not identified.

  This presents a particular risk where multiple topology errors occur. With increased penetration of renewable generation the State Estimator will face increased challenges and will be more vulnerable to such topological errors.
- Likelihood – Multiple topology errors are likely to occur when a multiple contingency event occurs just before the data is snapped for a run of the state estimator. This is likely to occur during major system events which although relatively infrequent are the times at which system security will be breached and may require immediate action by AEMO restore system security. The accuracy of the information available to power system security monitoring tools will be very important in these circumstances. In addition, renewable generation is now embedded in more remote parts of the network and the state estimator solution is thus now more sensitive to data from the more remote parts of the network.

The reduction in risk that will be achieved by the proposal. The proposed change would reduce the maximum delay by:

- 7 to 3 seconds for status indications classified as dispatch data
- 9 to 3 seconds for status indications classified as system security primary data.

The change can therefore be expected to reduce the period of risk and thus the likelihood by 60% or more.

The feasibility of alternative options. AEMO considers that potential alternatives to reducing the maximum end-to-end transmission times are not technically or economically feasible at this stage. Options AEMO has considered are:

- Upgrade the State Estimator so that it can also address topology errors. At this stage AEMO has assessed that available algorithms are not sufficiently reliable to achieve this.
- Run the power system security monitoring tools more frequently to ensure that a false solution is overwritten more quickly by a correct solution when the status indications have been received. AEMO has assessed that at this stage this is not feasible. The cycle time for these systems has only recently been reduced and it is considered that it could be a considerable time before the cycle time could be significantly reduced again.

However, AEMO appreciates that errors for some status indications in the dispatch and system security primary date categories are unlikely to create significant issues for the State Estimator. To ensure that the obligations in the Standard are proportionate to the risk, exceptions can be considered on a case-by-case basis, to extend the maximum time interval to 7 and 9 seconds respectively (as in the previous Standard). Exceptions would only be approved after consideration of the significance of the status indication for reliable operation of the State Estimator and reasons given by the DCP as to why it is not practical to achieve the default Standard time intervals. Approvals could be granted with conditions, for example achieving the Standard time intervals within a specified period, where AEMO expects the relevant indications to become more important.

4.5.3. AEMO's conclusion

AEMO will amend the Standard to include provision for DCPs to apply to AEMO for approval of a longer maximum time interval for end-to-end transmission of certain status indications (up to 7 seconds for dispatch data and 9 seconds for system security primary data). AEMO may approve exceptions (with or without conditions) if it considers the status indication is not significant for the reliable operation of the State Estimator and it is not reasonably practicable for the DCP to achieve the shorter time.

4.6. Data Accuracy (Section 2.5 of Standard)

4.6.1. Issue summary and submissions

Energy Queensland considered that the data accuracy requirements as written in the draft Standard would not be feasible to achieve. The combined definition of "True Value" and the wording of this clause means that readings would need to be accurate to within 1%, even when at extremely low levels. Energy Queensland observed that:

- Typically, transducers and other acquisition equipment have accuracy specifications related to their full-scale deflection (FSD). To meet normal operational requirements, the full scale is typically set significantly higher (150% or more) than the normal/nominal maximum expected reading so that when problems occur, readings do not clip at full scale (within reason). Taking a feeder current as an

example, on a 1200A rated circuit, the full scale may be as high as 2400A. If the analogue-to-digital sampling process has a specification of +/-0.25% of FSD, a reading of 6A is in the noise, yet by the wording of this clause, it would still be necessary to provide +/- 1% accuracy of this 6A reading (+/- 0.06A, or 0.0025% of FSD). Typically, at least 0.5% of that 1% allowance is consumed by the current transformer.

- The usual way to deal with this issue is to limit the window within which the accuracy requirement applies to a band around the normal / nominal value and accept that unusually high or low readings will be inaccurate.
- A broad generic specification of +/-1% accuracy is simple and convenient for data consumption but will also rule a large number of existing measurands as unfit for supply to AEMO. Our current standard for protection instrument transformers alone consumes that entire accuracy allowance, and metering quantities for Real and Reactive power (other than statistical metering and revenue metering) are specified for ±5% or better (with these having a compounded error from being calculated from two measured quantities).
- If AEMO is instead able to specify accuracy at the levels actually needed to perform its role and commensurate with the importance of the measurand, then significant unnecessary costs may be avoided.

4.6.2. AEMO's assessment

Accuracy of data is critical to the performance of power system applications. The more inaccurate the data, the greater the risk to power system security. AEMO therefore considers it imperative for the Standard to set an accuracy requirement that is as high as possible, although without imposing an unreasonable compliance burden on prudent DCPs or causing unintended consequences. Having considered the issues raised by Energy Queensland, AEMO will revise the requirements for data accuracy in section 2.5 of the Standard as follows:

The absolute value of the difference between the measured value and the true value should not exceed the following.

Data Category	**[4]True value less than 25% of Scale Range**	**True value between 25% and 80% of Scale Range**	**True value greater than 80% of Scale Range**
High Resolution Data (excluding PMU and HSM data)	0.25% of Scale Range	1 % of true value	1% of Scale Range
Dispatch Data	0.25% of Scale Range	1 % of true value	1% of Scale Range
System Security Primary Data	0.5% of Scale Range	2% of true value	2% of Scale Range
System Security Secondary Data	1.25% of Scale Range	5% of true value	5% of Scale Range

The DCF should be designed such that the Scale Range is adequate for all reasonably possible true values for that data point.

This requirement will apply to all new data points commissioned on or after 1 January 2024.

[4] This is the absolute value of this true value (e.g. 200MW if true value is -200MW)

This requirement will apply to existing data points (in service prior to 1 January 2024) only where AEMO identifies that the inaccuracy of a particular data point is creating operational issues. If so, then AEMO will advise the DCP of the need to undertake changes to ensure the accuracy of that data point meets the requirement set out in section 2.5 of the Standard. A transition process will apply similar to that proposed for other increased requirements in this version of the Standard.

By 31 January 2024, DCPs will also be required to advise AEMO of the current accuracy of all data points in service prior to 1 January 2024, to inform the tuning of the State Estimator application. AEMO may nominate a format for this information.

4.6.3. AEMO's conclusion

Section 2.5 of the Standard will be revised according to the approach set out in Section 4.6.2.

4.7. Physical security and computer network security (Section 4 of Standard)

4.7.1. Issue summary and submissions

Energy Queensland raised two issues regarding section 4 of the draft Standard.

- As regards section 4.4.1(e) on general obligations, Energy Queensland observed that the scope of the matters that could fall within this consultation requirement could be extremely broad. To prevent wasted effort by all parties, perhaps a guideline on the assessed consequence and likelihood of the risk to security would enable participants to only consult with AEMO on the matters AEMO considers to be significant enough to warrant its involvement.
- As regards section 4.4.2(b)(ii) on communications between RME/RCE and Intervening Facilities, Energy Queensland stated that this section as written effectively limits the communications to encrypted communications (which is possible but likely to be prohibitively expensive). Requiring encryption rules out any serial data communications or low-bandwidth wireless communications and removes most of the benefits of the use of DNP3-SAv5.

Energy Queensland observed that the principle behind the secure authentication developed for DNP3 was that SCADA data is typically not considered to be confidential. The additional processing and communications throughput overhead imposed by encryption typically serves little benefit in SCADA, and makes commissioning, fault diagnosis and maintenance significantly more complex, since a sanctioned "person-in-the-middle attack" needs to be performed to observe the meaning of the traffic independently of the end devices.

If the information is considered confidential only because it may be commercially sensitive rather than a risk to system security, Energy Queensland suggested a better approach would be to permit / allow for exemption from encryption where only a Secure Private Network is used and the DCPs involved are the parties at risk and agree the cost of encryption is not justified by the commercial risk.

TasNetworks also commented on section 4.4.2 of the draft Standard on communications between RME/RCE and Intervening Facilities as follows:

- The implementation of IEC 62351 as a requirement in section 4.4.2 increases the complexity of the communication mechanisms required by the Standard. This complexity not only increases costs from an equipment and management perspective, but also has the potential to reduce reliability if not adequately implemented or managed.

- Additionally, centralised network wide protection and control schemes are requiring ever decreasing times in which to operate. Encryption can add serialisation delays and overheads impacting the implementation of these critical schemes. TasNetworks requests AEMO consider the cost implications on networks and other parties of having to comply with both performance and security obligations.

Ausgrid stated that it might streamline compliance with the Standard if configurations that provide compliance are specified. e.g. layer of tunnelling for VPNs, crypto algorithms (vs the ASD listing) and minimum compensating controls. Ausgrid provided an example of where prescription might be useful, in requiring that the security controls must be consistent end to end. e.g. WAN encryption must be from AEMO control centre to NSP Intervening facility.

A possible scenario is that the NSP WAN is encrypted by an externally managed ICT system and is therefore vulnerable to 'eavesdropping' and 'man in the middle' attacks. Being more prescriptive about who owns the keys for a particular set of cryptographic algorithms, that are applied in a particular way to establish secure end to end comms, may drive a different solution. This might ensure the interpretation of "reasonable endeavours" doesn't result in an unexpected weakness in AEMO's WAN and control systems.

TasNetworks also raised the question of division of responsibilities when multiple DCPs are involved. TasNetworks said it was unclear - for data provided under the Standard by a TNSP but sourced via a third party - if the TNSP has the obligation or a mechanism to enforce the requirements of section 4 of the draft Standard. Although it is likely these requirements can be managed by the connections process for new participants, the expectation for existing participants is unclear.

4.7.2. AEMO's assessment

Section 4.4.1(e) is unchanged from earlier versions of the Standard and introduces no new requirements. AEMO believes that a requirement for a DCP to engage with AEMO in relation to "any matter that could reasonably be expected to adversely impact the security of DCFs or AEMO's WAN" is appropriate.

Regarding section 4.4.2(b), cyber security threats pose a material risk to critical infrastructure networks and appropriate security measures need to be considered in the protection of those systems and networks. IEC 62531 provides a reference model for considering security controls within the operational context and constraints of implementing organisations. Under IEC 62531 encryption is optional and the 'where possible' could be interpreted to mean that the technology exists and that it can be applied in an operationally and economically efficient manner. AEMO will amend 4.4.(b)(ii) to make it clear that such flexibility exists.

It was noted that such system protection schemes did not normally involve AEMO and so may be outside of the Scope of the Standard. In any case IEC 62351 provides some flexibility in such cases.

As regards the suggestion made by Ausgrid, AEMO's view is that the standard has focused on outlining a risk and principles-based approach rather than a prescriptive approach to accommodate the potentially broad range of technologies, arrangements, and contexts of DCPs. AEMO would be happy to consult further with DCPs on more specific configuration guidance following acceptance of the standard.

As regards the issue of data provided by third parties and the division of responsibilities for ensuring systems are adequate to meet the requirements, AEMO considers that section 9 addresses this issue as far as is possible within the Standard. In cases where a change is required to meet increased requirements of the Standard and requires work by more than one DCP, then each DCP is expected to

negotiate a transition plan under section 9.2 of the Standard, in consultation with AEMO and the other relevant DCPs.

4.7.3. AEMO's conclusion

Section 4.4.1(e) of the Standard will remain unchanged. Section 4.4.2 (b)(ii) will be amended to replace 'where possible' with 'where implementation is operationally and economically feasible'.

AEMO will engage, as required, with DCPs on more specific configuration guidance in the implementation of the revised Standard.

4.8. Testing (Section 6 of Standard)

4.8.1. Issue summary and submissions

As regards section 6.5(a) of the draft Standard, Energy Queensland offered a view that the term "test" in this section may not be appropriate, and it may be better to refer to "verification" of NSP's data against AEMO's data.

Energy Queensland also suggested that further clarity is required as to whether AEMO will be providing a template for the report referred to in section 6.5(e) of the draft Standard.

4.8.2. AEMO's assessment

As regards section 6.5(a), AEMO has considered the suggestion made by Energy Queensland but has concluded that the use of the term "test" is appropriate in this context and broad enough to encompass both verification and validation processes where relevant.

As regards section 6.5(e), AEMO considers that this proposal is at a level of detail that is outside of the scope of the Standard. AEMO will consult separately with DCPs as to the need for such a template.

4.8.3. AEMO's conclusion

AEMO has made no further changes to section 6.5 from the draft Standard.

4.9. PMU/HSM Devices (Section 7 of Standard)

4.9.1. Issue summary and submissions

Energy Queensland considers that the relevant protocol should be specified in this Standard. Otherwise, PMU and HSM devices should be excluded or the discussion around them moved to a non-normative appendix where it is clear that they are not part of the requirements for compliance.

4.9.2. AEMO's assessment

AEMO considers that the specification of provision of high resolution data from PMUs is not yet sufficiently mature for it to be included directly in the Standard, although this may well be possible in future versions of the Standard.

High resolution data from PMUs and HSMs are beginning to be used in the AEMO control rooms for operational purposes and thus are required to be addressed in the Standard.

PMU devices can also be configured to provide lower resolution data, similar to traditional transducers and in such cases those data points will be considered in the same manner as lower resolution data from traditional RME and subject to the same requirements under the Standard.

4.9.3. AEMO's conclusion

AEMO has made no further changes to section 7 from the draft Standard.

4.10. Consequences of non-compliance (Section 8 of Standard)

4.10.1. Issue summary and submissions

As regards section 8.1 of the draft Standard, Energy Queensland noted that consequences (b), (c) and (d) apply to the generator but it is unclear what enforcement action would be taken if the discrepancy is with an Intervening Facility.

4.10.2. AEMO's assessment

As explicitly recognised in section 1.6 of the Standard, satisfactory communication of data from remote facilities may rely on compliance by multiple DCFs. Participants using and providing intervening facilities are expected to make arrangements that facilitate achievement of the Standard.

AEMO is not in a position to specify what enforcement action might be taken for any given non-compliance, as the AER is responsible for compliance enforcement. In AEMO's view it can reasonably be expected that a compliance investigation would take interdependencies into account in determining any appropriate enforcement or remedial action.

As far as operational consequences are concerned, AEMO will need to consider what action is needed to address any impact on power system security, irrespective of the cause of the issue.

4.10.3. AEMO's conclusion

AEMO will include a reference to section 1.6 in section 8.1 of the Standard.

4.11. Transitional arrangements (Section 9 of Standard)

4.11.1. Issue summary and submissions

Energy Queensland noted that the effective date provided in section 9.1(a) of the draft Standard is 3 April 2023 which is different to the effective date of 1 April 2023 provided in section 9.

There were a range of stakeholder views on the scope and timing of the transitional arrangements proposed in the draft Standard.

Energy Queensland was of the view that the wording in section 9.1(a)(i) "12 months after the start of the next regulatory control period after the effective date for which the AER had not made a final distribution determination or transmission determination (as applicable) prior to the effective date" could be confusing. Energy Queensland also indicated this timeframe may not be achievable given the significant impacts of the proposed changes, shortage of appropriately skilled workers and ongoing international supply issues for items dependent on semiconductors.

Hydro Tasmania indicated that the proposed amendments to the Standard were appropriate and represent good engineering practice, even though some will present challenges, noting adequate time and planning is crucial to address all the requirements. Hydro Tasmania expects ongoing communications with AEMO to determine the details of transitioning to the new compliance requirements, as addressed in section 4.45.2 of the Draft Report and emphasised the need for value gained as the basis for any investment.

Hydro Tasmania considered that changes in the Standard should come into effect at the date of publication of the new Standard, in order to accommodate programs that are currently underway.

TasNetworks stated that the Standard as drafted does not provide either time frames or acceptable transition mechanisms to address the increased requirements. Application of section 4.4.2 of the Standard will require upgrades to communication infrastructure as well as both remote monitoring equipment (RME) and remote control equipment (RCE) within the network. To reduce the risk of inefficient investment in existing equipment it is requested that grandfathering of existing site capabilities be included in the Standard. This will allow networks to find efficiencies by combining upgrades with other works and to reduce the impact of increased costs on customers.

4.11.2. AEMO's assessment

The effective date in section 9 of the Standard should be 3 April 2023.

As regards the maximum time period allowed under section 9.1(a)(i), AEMO considers that the maximum timeframes set out in the draft standard are reasonable to allow DCPs adequate time to budget and plan for such work. DCPs are responsible for determining their initial compliance capability and any transitional needs. As highlighted by Hydro Tasmania's comments, DCPs should then communicate with AEMO as early as possible to determine any specific transition arrangements for their data communication systems. Noting Energy Queensland's drafting concerns, AEMO will adjust the wording relating to NSP revenue determinations to improve clarity.

AEMO believes that 3 April 2023 is an appropriate effective date as this allows DCPs the opportunity to determine whether or not they are able to comply with each increased requirement and to seek approval of appropriate transitional arrangements with AEMO as required. AEMO's final determination of the revised Standard will provide DCPs with certainty of the applicable requirements for the purposes of any work programs, notwithstanding that the amendments are not yet effective.

AEMO agrees that the scope of the transitional arrangements needs to be extended beyond those increased requirements in section 2 of the Standard to cover increased requirements in any relevant section of the Standard.

4.11.3. AEMO's conclusion

The effective date noted in the introduction to section 9 of the Standard is corrected to 3 April 2023.

The maximum time period allowed under section 9.1(a)(i) will not be changed from that proposed in the draft Standard, but paragraph (i) of the definition of 'transition date' is amended to clarify that it refers to the first regulatory period for which the AER makes a final determination after the effective date.

The introduction to section 9 will be amended to refer to increased requirements in sections 1 to 6 introduced in version 3.0 of the Standard.

4.12. Boundary of operational and financial responsibilities (Section 4.17 of Draft Report)

4.12.1. Issue summary and submissions

Delta Electricity suggested further consideration, perhaps before final determination, or else in a future review, to further advance fault management coordination. Delta Electricity stated that:

- With the onset of "cloud" based infrastructure and from recent and past experience, determining the location and ownership of faulted components is problematic.

- Design limitations may also make the identification of the faulted equipment difficult. As an example, a “watchdog” is included in dispatch data at some power stations and is relied upon to check data integrity whilst connected intervening facilities are understood to not be required to use or rely on such a signal for condition monitoring. Watchdog signals at the power stations have in the past been detected interrupted even when dispatch data has been unaffected. The opposite condition has also occurred where dispatch data has been dysfunctional and the watchdog intact. This could be considered an example of dysfunctional design. A more effective centrally designed watchdog system could drive improved data communications performance.
- It is considered theoretically feasible that appropriate “watchdog” designs carried through from participants to AEMO and mandatorily utilised by intervening facilities could be used to produce automated availability information, more efficiently confirming performance against the Standard’s objectives in real time, more effectively pinpointing location of fault and more rapidly driving repair efforts. It is not considered that “cloud”-based transfers without the ability to clearly identify, locate or assign fault ownership can ever drive best-practice performance. A design change may be required but the Standard may also need to better describe the design required or, if the Standard is not meant to be such a document, a Rule change may be required.

4.12.2. AEMO’s assessment

AEMO considers that the proposal regarding a structured watchdog system is worthy of more detailed consideration. Ultimately, however, it is the responsibility of each DCP to put in place appropriate processes to monitor its own compliance with the Standard. For this reason this will not be included as a requirement in this version of the Standard, but AEMO will endeavour to provide reasonable assistance to any DCP wishing to establish such a process.

4.12.3. AEMO’s conclusion

The requirement for a structured watchdog system will not be included as a requirement in the Standard. However AEMO will endeavour to provide reasonable assistance to any DCP wishing to establish such a process.

4.13. Information on settings for AGC systems (Section 4.27 of Draft Report)

4.13.1. Issue summary and submissions

Delta Electricity raised issues regarding the settings of the AGC system. It stated that it has experienced dysfunction related to a lack of communication transparency and understanding between technical personnel of AEMO and participants about the settings of the AEMO’s Automatic Generator Controller (AGC) and the dispatch of generating units, data for which is discussed in the Data Communication Standard. This dysfunction has recently been found to be due to a long-lived AGC setting. It is understood that the AGC may not be equipment meant for inclusion in the Data Communication Standard. Delta Electricity suggests, however, that dispatch accuracy and understanding could be improved via a document, like the Data Communication Standard, produced and consulted upon, and which describes the expectations of the AGC and its control process. It could be that a publicly consulted document and review process already exists for the AGC. If this is the case, Delta Electricity is eager to connect with the relevant AEMO team at the next AGC review or otherwise at any convenient time.

4.13.2. AEMO's assessment

AEMO has previously provided some information to DCPs regarding AGC settings, and will engage with relevant DCPs to understand what further information needs to be provided. These details do not fall within the scope of the Standard.

4.13.3. AEMO's conclusion

AEMO will engage with relevant DCPs to understand what further information needs to be provided. No change is required to the Standard.

4.14. General comments on Draft Report and Standard

CS Energy commented that it had reviewed the Report and Standard and is satisfied that AEMO has addressed and responded to the issues raised by CS Energy and other respondents in the First stage consultation. CS Energy has no further comments on the Draft Report and Draft Standard.

Delta Electricity noted that the data communication standard has undergone an extensive revision in this review and appears to have moved towards greater clarity of both purpose and explanation of details.

AEMO notes these comments and thanks all participants who have contributed to this consultation for their assistance and insights.

5. Other matters and further work

5.1. Drafting improvements

In addition to the drafting improvements outlined in Section 4 of this Final Report and section 5.1 of the Draft Report, further improvements to the final version of the Standard have been made as follows:

- Provisions added to section 6.5, to recognise that upgrades to RCE and RME will typically be subject to assessment for compliance with the corresponding performance standards (for generating systems in particular). The tests set out in the Standard should therefore be incorporated in the overall performance standards test plan.
- For consistency with NER definitions, references in the Standard to AEMO 'control centres' have been changed to '*AEMO co-ordinating centres*'. This denotes the control centre from which AEMO conducts market-related activities and the coordination of the operation of the national grid,
- Correction of minor typographical errors
- Correction to formatting of some cross references.

5.2. Further work

In considering a number of the issues raised in both the Draft and Final Reports, AEMO has committed to further work outside of this consultation. This includes the following:

- AEMO will consider the development of an industry guideline to provide more specific details on the data requirements for different types of DCP and types of data depending on use (refer section 4.1 of Draft Report).
- Review of the information currently provided to new connections regarding data communication requirements to see where it could be improved (refer section 4.12 of Draft Report).
- Engagement with stakeholders with regard to the proposed way forward with clamping of SCADA MW values (refer Section 4.23 of Draft Report).
- Examination of the issues raised by CS Energy on the dispatch conformance alert system and detailed aspects of operation of the AGC, considered outside of the scope of the Standard (refer section 4.27 of Draft Report).
- Investigation of options to improve monitoring and reporting to provide increased assurance that requirements of the Standard are being met (refer section 4.35 of Draft Report).
- Development of a "Real-time data equipment measurement guide" (refer section 4.37 of Draft Report).
- As required, development of guidelines and restrictions on use of the public internet for relevant DCPs (refer section 4.48 of Draft Report).
- Readiness activities for use of DNP3 data protocol as alternative to ICCP, and date to be set (refer Section 5.2.2 of the Standard).
- Organisation of annual forums to identify developing issues and help determine whether a further formal review of the Standard should be initiated (refer section 4.57 of Draft Report).
- Engagement with DCPS regarding the need for a template for the reporting required under Section 6.5(e) of the Standard (refer section 4.8.2 of this Final Report).

- Engagement with DCPs on more specific configuration guidance as required in the implementation of the revised Standard (refer section 4.7.2 of this Final Report).
- Provide reasonable assistance to any DCP wishing to establish a structured watch dog or similar process (refer section 4.12.2 of this Final Report).
- Working with DCPs to approve transitional plans as required (refer Section 4.11.2 of this Final Report).
- Nominate format for information on the accuracy of existing data points to be provided by DCPs (refer Section 4.6.2 of this Final Report).
- Engage with relevant DCPs to understand what further information is needed and can be provided on AGC system settings (refer Section 4.13.2 of this Final Report).
- Nominate date for use of DNP3 protocol (refer Standard Section 5.2.2(b)).

6. Determination

Having considered the matters raised in submissions, AEMO's determination is to amend the Power System Data Communications Standard in the form published with this Final Report, in accordance with clause **4.11.2(c)** of the NER.

Marked-up versions of the final Standard are also available showing changes between the final Standard and:

- the draft Standard published with the Draft Report, and
- the current version of the Standard (published in 2017).

The amended Standard will take effect from 3 April 2023, subject to the transitional arrangements where applicable.

Appendix A. Glossary

Term or acronym	Meaning
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AGC	Automatic Generation Control
ASD	Australian Signals Directorate
CA	Contingency Analysis
DCF	Data Communication Facility
DCP	Data Communication Provider
DER	Distributed Energy Resource
DNP3	Distributed Network Protocol 3
DNSP	Distribution Network Service Provider
Draft Report	Draft Report and Determination in this consultation
DRSP	Demand Response Service Provider
DSA	Dynamic Stability Analysis
EMS	Energy Management System
Final Report	This Final Report and Determination
GPS	Generator Performance Standards / Global Positioning System
HSM	High Speed Monitor
ICCP	Inter-Control Centre Protocol
IF	Intervening Facility
kV	kilovolts
MW	megawatt
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Provider
PMU	Phasor Measurement Unit
RCE	Remote Control Equipment
RME	Remote Monitoring Equipment
SCADA	Supervisory Control and Data Acquisition
Standard	Power System Data Communications Standard
TNSP	Transmission Network Service Provider
VDS	Var Dispatch Scheduler
VSAT	Voltage Stability Analysis Tool
WAN	Wide Area Network

Appendix B. Summary of second stage submissions and AEMO responses

No.	Issue	Submissions	AEMO response
1	Definition of Operational Data	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: The definition of "Operational Data" previously captured all four types of data listed below. However, reference is made to "Operational Data" in some sections (for example, section 5.2.1) which excludes High Resolution Data. Therefore, it is recommended that "High Resolution Data" is removed from the definition of "Operational Data" to avoid confusion. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.1
2	Definition of Primary System Security Data	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: It is unclear why the "'at least 220kV" reference is included. It is our understanding that 132kV would be the minimum level of interest, given the transmission network includes voltages at that level. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.1
3	Definition of Secondary System Security Data	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: To a Network Service Provider (NSP), "Secondary System" refers to devices such as protection relays, remote terminal units and tap changers, i.e. items that control / monitor primary plant. The use of the term "Secondary System" may therefore result in confusion. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.1
4	Definition of High Resolution Data	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: It is suggested that "'a typical sample rate of 20 millisecond intervals" should be replaced by "'50 samples per second" to provide greater clarity. In addition, the definition is limited to devices with GPS clock synchronisation, whereas there are multiple time sources available that can achieve the required accuracy. It is therefore suggested that a timestamp resolution requirement should instead be included in the definition, such as "microsecond accuracy" (preferably no tighter tolerance than is actually required). Hydro Tasmania: No comment	Refer Sect 4.1

No.	Issue	Submissions	AEMO response
		TasNetworks: No comment	
5	Definition of Secure Private Network	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: The requirements set out in section 5.1(d) suggest that “Secure Private Network” is intended to exclude any public carrier network. However, the current wording for this definition could be interpreted to also include Virtual Private Networks or other end-to-end encrypted communication paths over public or multi-user commercial telecommunications infrastructure. In refining this definition, care should also be taken to not exclude standard aggregation of telecommunications channels (PDH, SDH, MPLS, etc.) that will occur on any communications network of significant size. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.1
6	HSM & PMU data and ICCP Protocol	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: It is Energy Queensland’s understanding that HSM and PMU data collected by the NSP will not be able to transmit the microsecond accuracy timestamp required via the ICCP protocol. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.2
7	Inability to transmit controls over ICCP links in series	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: It is our understanding that there is no way to transmit controls across more than one ICCP link in series without customer application software or customer DMS / EMS logic. Therefore, the secondary option of the DNSP going via the TNSP is not suitable for controls unless an alternative protocol, such as DNP3, is used between the DNSP and TNSP. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.2
8	Need for further details in Fig 1 in section 1.5	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Figure 1 (General Structure of DCF) does not reflect the option as outlined in section 1.4.1(b)(i) of the DNSP (Intervening Facility 2) having direct connections to each of the AEMO control centres. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.3
9	Cross referencing issue	Ausgrid: No comment CS Energy: No comment	Refer Sect 5.1

No.	Issue	Submissions	AEMO response
		Delta Electricity: No comment Energy Queensland: Problem with cross referencing in section 2.1(c) Hydro Tasmania: No comment TasNetworks: No comment	
10	Need for clarity regarding quality flags	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Further clarity is required as to the meaning of “default state must be set to good”. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.4
11	Concerns regarding reduction in maximum delay times for status indications	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Table 2 (End to End Time for data to be available for transmission to AEMO) – The status indications for Dispatch Data and Primary System Security Data have lowered significantly from the previous Standard. It is not clear that these status indications are practical and would need to be tested. However, this may not be an issue if we move to a direct connection to AEMO rather than via the TNSP. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.5
12	Concerns regarding new requirements re data accuracy	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: As written, this requirement would not be feasible to achieve. The combined definition of “True Value” and the wording of this clause means that readings would need to be accurate to within 1%, even when at extremely low levels. Typically, transducers and other acquisition equipment have accuracy specifications related to their full-scale deflection (FSD). To meet normal operational requirements, the full scale is typically set significantly higher (150% or more) than the normal / nominal maximum expected reading so that when problems occur, readings do not clip at full scale (within reason). Taking a feeder current as an example, on a 1200A rated circuit, the full scale may be as high as 2400A. If the analogue-to-digital sampling process has a specification of +/-0.25% of FSD, a reading of 6A is in the noise, yet by the wording of this clause, it would still be necessary to provide +/- 1% accuracy of this 6A reading (+/-0.06A, or 0.0025% of FSD). Typically, at least 0.5% of that 1% allowance is consumed by the current transformer. The usual way to deal with this issue is to limit the window within which the accuracy requirement applies to a band around the normal / nominal value and accept that unusually high or low readings will be inaccurate. A broad generic specification of +/-1% accuracy is simple and convenient for data consumption but will also rule a large number of existing measurands as unfit for supply to AEMO. Our current standard for protection instrument transformers alone consumes that entire accuracy allowance, and metering quantities for Real and Reactive power (other than statistical metering and revenue	Refer Sect 4.6

No.	Issue	Submissions	AEMO response
		metering) are specified for ±5% or better (with these having a compounded error from being calculated from two measured quantities). If AEMO is instead able to specify accuracy at the levels actually needed to perform its role and commensurate with the importance of the measurand, then significant unnecessary costs may be avoided. Hydro Tasmania: No comment TasNetworks: No comment	
13	Concerns regarding scope of data security issues required to be advised to AEMO	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: The scope of the matters that could fall within this consultation requirement could be extremely broad. To prevent wasted effort by all parties, perhaps a guideline on the assessed consequence and likelihood of the risk to security would enable participants to only consult with AEMO on the matters AEMO considers to be significant enough to warrant its involvement. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.7
14	Document formatting error	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Document formatting error - cross reference to “(d)5.1(d)” should be amended to “5.1(d)”. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 5.1
15	Concerns regarding need for encryption of data between RME/RCE and IF	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: This section as written effectively limits the communications to encrypted communications (which is possible but likely to be prohibitively expensive). Requiring encryption rules out any serial data communications or low-bandwidth wireless communications and removes most of the benefits of the use of DNP3-SAv5. The principle behind the secure authentication developed for DNP3 was that SCADA data is typically not considered to be confidential. The additional processing and communications throughput overhead imposed by encryption typically serves little benefit in SCADA, and makes commissioning, fault diagnosis and maintenance significantly more complex, since a sanctioned “person-in-the-middle attack” needs to be performed to observe the meaning of the traffic independently of the end devices. If the information is considered confidential only because it may be commercially sensitive rather than a risk to system security, then perhaps a better approach would be to permit / allow for exemption from encryption where only a Secure Private Network is used and the DCPs involved are the parties at risk and agree the cost of encryption is not justified by the commercial risk. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.7

No.	Issue	Submissions	AEMO response
16	Inconsistent use of term "Operational Data"	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Operational Data section 1.7 dot point 4 indicates that the HSM and PSU data is excluded, whereas they are included in the definition of "Operational Data". Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect **Error! Reference source not found.**
17	Use of term "testing" in reference to checking NSP data against AEMO data	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: In our view, use of the term "test" in this section may not be appropriate. It may be more appropriate to refer to "verification" of NSP's data against AEMO's data. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.8
18	Will AEMO provide a template for reporting?	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Further clarity is required as to whether AEMO will be providing a template for the report referred to in this section. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.8
19	Specification of requirements for HSM and PMU devices	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Energy Queensland considers that the relevant protocol should be specified in this Standard. Otherwise, PMU and HSM devices should be excluded or the discussion around them moved to a non-normative appendix where it is clear that they are not part of the requirements for compliance. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.9
20	What are the enforcement actions if a non-compliance occurs within an IF?	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: It is noted that consequences (b), (c) and (d) apply to the generator but it is unclear what enforcement action would be taken if the discrepancy is with an Intervening Facility.	Refer Sect 4.10

No.	Issue	Submissions	AEMO response
		Hydro Tasmania: No comment TasNetworks: No comment	
21	Documenting Format errors in Sect 9	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: Noted two document formatting errors in Sect 9. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 5.1
22	Inconsistency in nomination of effective date for the Standard	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: The effective date provided is 3 April 2023 which is different to the effective date of 1 April 2023 provided in section 9. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.11
23	The maximum time allowed to complete transitional processes is inadequate	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: In our view, “12 months after the start of the next regulatory control period after the effective date for which the AER had not made a final distribution determination or transmission determination (as applicable) prior to the effective date” could be confusing. This timeframe may also not be achievable given the significant impacts of the proposed changes, shortage of appropriately skilled workers and ongoing international supply issues for items dependent on semiconductors. Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.11
24	Need to specify configurations that would provide compliance	Ausgrid: It might streamline compliance with the standard if configurations that provide compliance are specified. e.g. layer of tunnelling for VPNs, crypto algorithms (vs the ASD listing) and minimum compensating controls. An example of where it might be good to be prescriptive is to say that the security controls must be consistent end to end. e.g. WAN encryption must be from AEMO control centre to NSP Intervening facility. A possible scenario is that the NSP WAN is encrypted by an externally managed ICT system and is therefore vulnerable to eavesdropping and man in the middle attacks. Being more prescriptive about who owns the keys for a particular set of cryptographic algorithms, that are applied in a particular way to establish secure end to end comms, may drive a different solution. This might ensure the interpretation of “reasonable endeavours” doesn’t result in an unexpected weakness in AEMO’s WAN and control systems. CS Energy: No comment Delta Electricity: No comment	Refer Sect 4.7

No.	Issue	Submissions	AEMO response
		Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: No comment	
25	Proposal to improve fault management co-ordination	Ausgrid: No comment CS Energy: No comment Delta Electricity: Delta Electricity looks forward to further consideration, perhaps before final determination, or else in a future review to further advance fault management coordination. It is particularly obvious with the onset of "cloud" based infrastructure and from experience with dysfunction, both recent and in the past, that determining the location and ownership of faulted components is problematic, without which, motivating and funding technical investigation teams is challenged. Design limitations may also exist that make the identification of the faulted equipment difficult. As an example, a "watchdog" is included in dispatch data at some power stations and is relied upon to check data integrity whilst connected intervening facilities are understood to not be required to use or rely on such a signal for condition monitoring. Watchdog signals at the power stations have in the past been detected interrupted even when dispatch data has been unaffected. The opposite condition has also occurred where dispatch data has been dysfunctional and the watchdog intact. This could be considered an example of dysfunctional design. A more effective centrally designed watchdog system could drive improved data communications performance. It is considered theoretically feasible that appropriate "watchdog" designs carried through from participants to AEMO and mandatorily utilised by intervening facilities could be used to produce automated availability information, more efficiently confirming performance against the Standard's objectives in real time, more effectively pinpointing location of fault and more rapidly driving repair efforts. It is not considered that "cloud"-based transfers without the ability to clearly identify, locate or assign fault ownership can ever drive best-practice performance. A design change may be required but the Standard may also need to better describe the design required or, if the Standard is not meant to be such a document, a Rule change may be required. Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.12
26	Issues with information on AGC settings	Ausgrid: No comment CS Energy: No comment Delta Electricity: Delta Electricity has also experienced dysfunction related to a lack of communication transparency and understanding between technical personnel of AEMO and participants about the settings of the AEMO's Automatic Generator Controller (AGC) and the dispatch of generating units, data for which is discussed in the Data Communication Standard. This dysfunction has recently been found to be due to a long-lived AGC setting. It is understood that the AGC may not be equipment meant for inclusion in the Data Communication Standard. Delta Electricity suggests, however, that dispatch accuracy and understanding could be improved via a document, like the Data Communication Standard, produced and consulted upon, and which describes the expectations of the AGC and its control process. It could be that a publicly consulted document and review process already exists for the AGC. If this is the case, Delta Electricity is eager to connect with the relevant AEMO team at the next AGC review or otherwise at any convenient time Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.13

No.	Issue	Submissions	AEMO response
27	Need for ongoing communication on need for transitional arrangements and earlier effective date	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: No comment Hydro Tasmania: As an established generator, Hydro Tasmania finds the proposed amendments to the Standard appropriate, noting the need for adequate time and planning is crucial to address all the requirements. Although some of the proposed changes will present challenges, Hydro Tasmania considers that they represent good engineering practice. We expect ongoing communications with AEMO to determine the details of transitioning to the new compliance requirements, as addressed in Section 4.45.2. of the 'Draft Report and Determination' and emphasise the need for value gained as the basis for any investment. Hydro Tasmania considers that changes in the Standard should come into effect at the date of publication of the new Standard, in order to accommodate programs that are currently underway. We would welcome the opportunity to discuss these proposed changes with AEMO in a private forum, given that this is a matter of data security. TasNetworks: No comment	Refer Sect 4.11
28	Application of transitional arrangements to meet increased security requirements	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: The proposed Standard has expanded the requirements of section 4 (Security). The Standard as drafted does not provide either time frames or acceptable transition mechanisms to address the increased requirements of the Standard. Application of section 4.4.2 of the Standard will require upgrades to communication infrastructure as well as both remote monitoring equipment (RME) and remote control equipment (RCE) within the network. To reduce the risk of inefficient investment in existing equipment it is requested that grandfathering of existing site capabilities be included in the Standard. This will allow networks to find efficiencies by combining upgrades with other works and to reduce the impact of increased costs on customers.	Refer Sect 4.11
29	Concerns re application of IEC 62351 to communications between RME/RCE and IFs	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: The implementation of IEC 62351 as a requirement in section 4.4.2 increases the complexity of the communication mechanisms required by the Standard. This complexity not only increases costs from an equipment and management perspective, but also has the potential to reduce reliability if not adequately implemented or managed. Additionally, centralised network wide protection and control schemes are requiring ever decreasing times in which to operate. Encryption can add serialisation delays and overheads impacting the implementation of these critical schemes. TasNetworks	Refer Sect 4.7

No.	Issue	Submissions	AEMO response
		requests AEMO consider the cost implications on networks and other parties of having to comply with both performance and security obligations.	
30	Query regarding situational where action to address an increased requirement will require action by multiple DCPs	Ausgrid: No comment CS Energy: No comment Delta Electricity: No comment Energy Queensland: No comment Hydro Tasmania: No comment TasNetworks: Lastly, it is unclear for data provided under this Standard by a TNSP, but sourced via a third party, if the TNSP has the obligation or a mechanism to enforce the requirements of section 4 of the draft Standard. Although it is likely these requirements can be managed by the connections process for new participants, the expectation for existing participants is unclear.	Refer Sect 4.7
31	General Comments on Draft Report	Ausgrid: No comment CS Energy: CS Energy has reviewed the Report and Standard and is satisfied that AEMO has addressed and responded to the issues raised by CS Energy and other respondents in the First stage consultation. CS Energy has no further comments on the Draft Report and Draft Standard Delta Electricity: The data communication standard has undergone an extensive revision in this review and appears to have moved towards greater clarity of both purpose and explanation of details. Energy Queensland: : No comment Hydro Tasmania: No comment TasNetworks: No comment	Refer Sect 4.14