AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

ELECTRICITY RULE CHANGE PROPOSAL

INTEGRATING ENERGY STORAGE SYSTEMS INTO THE NEM

August 2019

CONTENTS

1. SUMMARY

The current regulatory framework reflects and supports a traditional electricity supply chain model, where electricity is produced by large generators (suppliers) and transported through transmission and distribution systems to industrial, commercial, and residential customers (consumers) who purchase the electricity.

The NEM is experiencing fundamental change and the National Electricity Rules (NER, or rules) must adapt to a present and future situation where:

- There are increasing numbers of, and interest in connecting, energy storage systems (ESS)[1] in the national electricity market (NEM) to support variable renewable energy (VRE), provide grid support services and leverage energy arbitrage opportunities. This is already occurring in both distribution and transmission systems.
- The number of connection points with two-way electricity flows continues to grow, including:
  - Residential customers with installed devices, e.g. rooftop photovoltaic (PV) and batteries.
  - 'Hybrid' facilities connecting to the grid with a mix of technology types at a single connection point.

AEMO recognises that the NEM's regulatory framework and the processes and systems that support it, need to transition and prepare for a future where there is expected to be less reliance on 'traditional' technologies. The current framework is designed around binary concepts of 'generation' and 'load' and the assumption of a one-to-one relationship between a given type of registered participant and an asset at a connection point that must (typically) be classified as either generation or load.

This rule change proposal seeks to more efficiently accommodate increasing numbers of connections where bi-directional electricity flows occur and business models where there are a mix of technology types are connecting behind a connection point. AEMO proposes to create a new registered participant category, termed a Bi-directional Resource Provider, in Chapter 2 and integrate this through the rest of the NER. A person with a stand-alone ESS or 'hybrid' facility would register and participate under this new category. Under the proposed rule:

- An applicant could register in a single registered participant category to provide services from a scheduled bi-directional unit (the term used for an ESS) or a combination of assets – bi-directional unit with a market load and/or market scheduled or semi-scheduled generating units, or a market load and market generating unit.
- A scheduled bi-directional unit would typically participate as a single asset with a single bid in central dispatch and could provide energy, ancillary services and other non-energy services (directions etc).
- AEMO would have a power to exempt persons with bi-directional facilities and the plant within from the registration requirement; these would be termed small bi-directional units and could be classified by a Market Small Generation Aggregator (MSGA).
- For the proposed Bi-directional Resource Provider and MSGA registered participant categories, non-energy costs are to be recovered from these categories based on their consumed and sent out energy for trading intervals where they contribute to the need for provision of those services.
- Consistent with the current policy for connected generating systems:
  - Transmission use of system (TUOS) charges should not be charged for bi-directional assets.

[1] Termed 'bi-directional units' in the proposed rule.

  - Distribution use of system (DUOS) should be charged for the consumption from a bi-directional unit.

- Definitions and changes have been included to integrate the Bi-directional Resource Provider, bi-directional facilities, bi-directional units and ancillary services bi-directional units into the NER.

AEMO has provided proposed drafting to Chapters 2, 3 and 10 of the NER with this rule change proposal. For other relevant NER chapters, the proposal includes the principles AEMO considers should be applied to incorporate Bi-directional Resource Providers into the framework. In the drafting for Chapter 3 in particular, AEMO has proposed changes that incorporate this new category, wherever possible, in a way that simplifies and consolidates the drafting. Terms that currently represent load and generation have also been redefined in a way that facilitates greater recognition of two-way flows and 'hybrid' facilities that produce and consume energy in different ways and at different times or simultaneously.

2. RELEVANT BACKGROUND

2.1 A changing energy market and a binary framework

While some forms of ESS have been connected to the grid since NEM start, with pumped hydro, proponents are now more frequently including ESS (mainly batteries) in their facilities and portfolios. AEMO expects the role of inverter-connected ESS in the power system, which provide energy and system support services, will continue to grow.

Following the registration and connection of the first NEM grid-scale battery in November 2017 (the Hornsdale Power Reserve battery system), AEMO has registered three further ESS and continues to receive registration and connection enquiries and applications relating to ESS, as:

- Individual connections.
- Part of a 'hybrid' facility (ESS coupled with a generating system and/or industrial loads).

Section 0 of this rule change proposal explains how these assets are currently accommodated in the NEM.

In late 2017, AEMO started reviewing the existing NEM framework (including the NER, procedures, and systems) and processes associated with the participation of these new types of facilities and business models and found:

- While AEMO has been able to register these facilities to participate in the NEM, the experience with registration and connection and subsequent operation in the market makes it clear that the existing registered participant categories cannot adequately and efficiently accommodate ESS.
- It is evident that existing AEMO systems and processes were not designed for ESS, or the types of new grid-scale business models that are being proposed now or may be proposed in the future. While AEMO has identified and implemented immediate changes to address some issues, there is a need to be future-focused and consider broader changes that facilitate ESS and the effective operation of the NEM.

The NEM is also seeing continued development of business models that include smaller-scale ESS and photovoltaic (PV). AEMO expects the ESS demand to increase:

- In the short-term as:
  - Funding provided from the Australian Renewable Energy Agency (ARENA) and state-based programs (e.g. New South Wales Emerging Energy Program, and Victorian Renewable Energy Action Plan) encourages and increases investment in new renewable electricity business models, including those with ESS.
  - VRE proponents seek to store electricity produced onsite (behind the connection point) to provide later to the grid or for a co-located industrial customer's consumption.
- In the long-term, the cost of ESS reduces as technological or demand drives this change.

In distribution system, the Clean Energy Council (CEC) reports that 2 million households have rooftop PV and demand for household ESS is growing[2].

The current NEM regulatory framework was not designed with these business models and production/consumption patterns in mind. While the National Electricity Law (NEL) and NER are underpinned by economic supply chain fundamentals, including demand, supply and transport, the asset-based characterisation of connection point flows, with corresponding participant classifications, reflects the

[2] Clean Energy Council website, see: https://www.cleanenergycouncil.org.au/news/number-of-australian-homes-with-rooftop-solar-tops-2-million-and-counting.

power system as it was before NEM commencement. At this time, almost all demand was met by large grid-scale generation, and the two key types of traders in the NEM were Market Generators and Market Customers, each were assumed to be overwhelmingly only producers or consumers of electricity respectively.

The NER uses the following terms to describe the electricity that is consumed from and produced to the grid at a connection point:

- 'Load' refers to the electricity consumed from the grid, but also to the asset.
- 'Generate', 'generation', 'generating' or 'sent out generation', refers to electricity produced or sent out to the grid.
- For network services, import and export of electricity concepts are used.

Except for market network services, auxiliary supply associated with generation, and micro-embedded generation at the retail customer level, typically the NER do not recognise significant bi-directional flows at connection points.

2.2 Background – AEMC reviews and 2016 Rule change

In 2015, the AEMC recognised the increasing interest and application of ESS and began its Integration of Energy Storage Review. One of the review's key findings was that a new category of registered participant was not required to integrate ESS into the NEM[3].

In the AEMC's review consultation, stakeholders discussed whether the definition of generating unit captured all ESS. The AEMC recommended that an interested party submit a Rule change to ensure the definition of 'Generator' and 'generating unit' was unambiguously included ESS. Subsequently, AEMO submitted a Rule change and the AEMC made this Rule in 2016[4].

As a result of that Rule change, the NER definition of generating system is sufficiently broad to include an ESS' produced electricity. To facilitate the participation of ESS (more recently battery systems), AEMO has interpreted the existing NER to mean that a person who owns, operates or controls a grid-scale battery or pumped hydro and wishes to participate in the NEM must register as a Market Generator (for the sent out electricity to the grid), and also as a Market Customer (for the consumed electricity from the grid)[5].

In mid-2016, the AEMC initiated the Coordination of Generation and Transmission Investment (CoGaTI) Review, which overlapped with the timing of AEMO's Emerging Generation and Energy Storage (EGES) work.

In December 2018, the AEMC published its CoGaTI Final Report. Among other topics, this report explored ESS-related issues, including the appropriate registered participant category and transmission use of system (TUOS) charges[6].

The CoGATI Final Report acknowledged AEMO's work in analysing and consulting on the issues and potential solutions for a long-term approach on ESS, regarding the appropriate registered participant category and how it should be treated under the regulatory framework. Additionally, the Commission agreed with AEMO's EGES proposal that "…to improve clarity for energy storage system proponents and remove operational inefficiencies for both registered participants and AEMO, a new NEM registration category should be created to accommodate energy storage systems."

[3] AEMC, Final Report, Integration of Energy Storage, 3 December 2015.
[4] AEMC, National Electricity Amendment (Registration of proponents of new types of generation) Rule 2016 No. 4.
[5] Where an ESS proponent does not wish to purchase electricity from the NEM, it is not required to register as a Market Customer.
[6] AEMC, Options Paper, CoGaTI, 21 September 2018.

2.3 Background – AEMO's Emerging Generation and Energy Storage (EGES) initiative

As a part of AEMO's EGES initiative, AEMO identified and discussed the challenges with respect to registering and connecting plant in the NEM:

- December 2017 and March 2018 – EGES stakeholder workshop sessions where the challenges were discussed at both sessions and relevant materials were published on AEMO's website.
- November 2018 – the EGES Stakeholder Paper was published, which identified the issues regarding the current treatment of ESS, potential to define ESS, options to integrate ESS into the NEM regulatory framework, and AEMO's proposed approach. Two stakeholder sessions were held.

The majority of stakeholder feedback provided in written submissions and in the two stakeholder sessions held in November 2018 indicated positive support for AEMO's preferred option (option 2a in the Stakeholder Paper) for the NER to:

- Define ESS.
- Create a new Bi-directional Resource Provider category, allowing them to classify:
  - A bi-directional unit.
  - A bi-directional unit with a generating unit and/or load.
  - Load and generation.
- Allow the bi-directional asset to participate in dispatch as a single asset with a single dispatchable unit identifier (DUID).
- Integrate the new Bi-directional Resource Provider in the NER in respect of key NER requirements.
- Clarify non-energy recoveries and fees, including TUOS and DUOS.

Appendix A includes a summary of written feedback. Meeting notes are on AEMO's website.

Table 1 sets out the objections or reservations expressed in relation to the proposal and AEMO's response. Appendix A includes a summary of all stakeholder feedback in response to the EGES Stakeholder Paper.

Table 1: EGES stakeholder feedback

Consultation Feedback – Issues	Stakeholders	AEMO's Response
More detail is needed around flexibility of option 2a for 'hybrid' facilities. Key areas requiring clarification: 1. Is aggregation of co-located assets mandatory? 2. How will this work for co-located assets within a facility that fit different registrable capacities? (scheduled/semi-scheduled/non-scheduled)? 3. The applicable technical requirements?	CEC, Energy Australia, Energy Queensland, Origin, Tesla, Tilt Renewables, W. Wightman Advisory	Where a person has a 'hybrid' facility, they will be required to register in the Bi-directional Resource Provider category to provide a bi-directional facility – this may include a bi-directional unit and generating unit or load. A proponent would have the ability to choose whether to aggregate units of the same technology type, this is like what occurs under the existing arrangements, e.g. under NER clause 3.8.3 a Scheduled Generator may aggregate scheduled generating units. Similarly, under the proposed rule a Bi-directional Resource Provider can aggregate either bi-directional units or semi-scheduled generating units – but not dissimilar technology types. Refer to AEMO's response to question 1. The proposed bi-directional facility could include a bi-directional asset with a scheduled generating unit or a semi-scheduled generating unit. For each of these units the Bi-directional Resource Provider would have NER responsibilities that are relevant to those assets. Noting that a non-scheduled generating unit is not proposed to be a classified asset in a bi-directional facility. Performance standards are applicable at a registered participants connection point, including for the Bi-directional Resource Provider. For the bi-directional facility or asset, these would reflect the minimum or negotiated NER technical requirements at the relevant connection point. In NER Chapters 4 and 5, the proposed rule would integrate the Bi-directional Resource Provider, bi-directional facility and bi-directional unit and ensure relevant technical requirements for bi-directional facilities and bi-directional units are applicable.
AEMO should consider the following issues in relation to the proposed definition of ESS: 1. The definition of ESS should allow energy to be received or sent back to sources/destinations other than the grid or customer at the same site. 2. The definition of ESS should build on the OFGEM/FERC definition that refers specifically to electricity rather than energy. 3. AEMO should consider including the phrase 'ancillary and auxiliary support' to ensure that ancillary services that may be provided by ESS are included. 4. AEMO should consider defining the word 'later' to avoid picking up infrastructure such as capacity banks.	GE, Hydrostor, UPC renewables, S&C, Tilt Renewables, W. Wightman Advisory, AGL, Energy Queensland	The proposed definition of an ESS allows electricity to be consumed from the grid or another source at the site. For a bi-directional facility (which functions as a single entity) electricity flows from an on-site generating unit or to a market load would be allowed. The electricity flow measured at the connection point is used for settlement, prudentials and calculation of marginal loss factors (MLFs). AEMO has proposed that an ESS may provide ancillary services. To provide ancillary services the Bi-directional Resource Provider will need to classify its bi-directional unit as an 'ancillary services generating unit' Capacitor banks, reactors, static VAR compensators and synchronous condensers are all reactive power devices. These are defined in the NER and specifically used to relate to distribution or transmission lines and generating units.
TUOS and DUOS:	AGL, W. Wightman Advisory	Refer to section 4.2.3 for further information.

Consultation Feedback – Issues	Stakeholders	AEMO's Response
1. ESS should be charged based on its consumed energy, the same as market loads. 2. 'Hybrid' facilities that include market loads should not be able to register under the new registrable capacity and thereby avoid TUOS/DUOS.	CEC	1. AEMO agrees that 'hybrid' facilities that include market load (assuming the NER does not require TUOS to be charged to an ESS) should not avoid TUOS charges. The energy flows will need to be metered and measured appropriately to prevent the Bi-directional Resource Provider avoiding TUOS charges. AEMO recognises that there will be challenges in metering and measurement of the market load energy and further arrangements need to be considered to ensure these processes are consistent across the NEM. Aside from these challenges, AEMO does not see a rationale for excluding market load from the 'hybrid' facility. In principle, a proponent should have the flexibility to choose a configuration that works best for their business model and, behind the connection point, be able to export electricity to meet the market load's consumption.
More detail is needed around likely provisions on grand-fathering/transition.	Hydrostor, Snowy Hydro, ENEL, Tesla	AEMO proposes that registered participants with an ESS continue under their existing categories. If they wish to change to the new category, they would apply to AEMO to do so.
What is the expected outcome with respect to receiving an AGC signal where an ESS is additional to an existing semi-scheduled wind or solar farm that did not have AGC capability?	Meridian Energy	Where a person proposes a bi-directional facility, including where a bi-directional unit is co-located with an existing semi-scheduled generating unit, the connection agreement is re-negotiated with the network service provider (NSP) since the registered facility's capacity and connected plant has changed. Where this occurs, current NER requirements must be met for the facility as a whole, including ensuring that the existing semi-scheduled generating units have adequate communication and telemetry and meet technical requirements.
ESS can provide firming services for VRE, including for hedging positions and for causer pays exposure. Firming should be allowed on a virtual basis (across separate connection points but within the same RRN)?	Edify	This is outside of the scope of AEMO's rule change proposal. Under the terms of AEMO's Regulation frequency control and ancillary services (FCAS) Contribution Factors Procedure, AEMO aggregates causer pays factors across a registered participant's portfolio.
Generators should be able to charge a battery with any energy being generated over a curtailment cap (via an embedded network) whilst still being able export (and be paid for) energy below the cap; and/or allow relevant participation in FCAS markets.	Tesla	Where a bi-directional facility includes a co-located bi-directional unit and generating unit and there are network constraints limiting the exported electricity to the grid, the Bi-directional Resource Provider's generating unit would be able to export its electricity (what cannot be exported due to the constraint) to the bi-directional unit to be storage for later use. The electricity or FCAS provided to the grid will receive the relevant spot or FCAS price.

2.4 Current NEM arrangements

The current NEM arrangements that are relevant for stand-alone ESS and 'hybrid' facilities are set out below.

2.4.1 Current arrangements for stand-alone ESS

Registration and connection arrangements

Currently, the NER does not specifically identify ESS. Following the rule change that broadened the definition of 'generating unit', AEMO accommodated bi-directional units by considering these assets as generating systems and loads under the NER. This approach has been used for grid-scale batteries and pumped hydro facilities, however in some cases the pumped hydro operators have only been registered as a Generator although consumption by the pumps operates as a scheduled load in dispatch and, historically, treated as auxiliary supply.

Under AEMO's Interim Arrangements for Utility Scale Battery Technology (Battery Interim Arrangements), a person who owns, operates, or controls a grid-scale ESS must typically register as both a Market Generator (scheduled generating unit) and Market Customer (scheduled load)[7].

Under the NER, a person with a generating system must be registered, unless otherwise exempted by AEMO. If a generating system has a nameplate rating of 30 MW or more, it must either be classified as a scheduled generating unit or semi-scheduled generating unit, unless AEMO approves its classification as a non-scheduled generating unit.

AEMO can exempt a person from the requirement to register a generating system that has a nameplate rating less than 30 MW. Conditions for exemption are in AEMO's Guide to Generator Exemptions and Classification of Generating Units[8]. Under this guide, an owner, operator or controller of a battery system that has a nameplate rating that is:

- 5 MW or above is required to register as a Market Generator (classified as a scheduled generating unit) and Market Customer (classified as scheduled load)[9].
- Less than 5 MW is granted exemption from registration[10].

A person who owns, operates, or controls a pumped hydro system, which would typically have a nameplate rating of 30 MW or more, registers and classifies its generating units as scheduled generating units.

Additionally, where a person with an ESS that has a nameplate rating less than 5 MW is exempt from registration (because it is currently being treated as a generating system) and is consuming electricity from the grid (therefore purchasing electricity from the NEM), the load component is treated as 'auxiliary' supply. While the NER does not define 'auxiliary' it is referenced in the definitions of generating system and continuous uninterrupted operation. In both definitions, auxiliary supply refers to providing support or assistance.

[7] For more information, see https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Participant-information/New-participants/Interim-arrangements-Utility-Scale-Battery-Technology.

[8] Refer to AEMO's website at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Participant-information/New-participants/Exemption-and-classification-guides.

[9] In the case of a generating system with a battery that is integrated with another type of generation and will never be charging from the grid, AEMO will consider a proposal that the proponent not register as a Market Customer, provided that appropriate arrangements are put in place for the charging activity to be dispatched through central dispatch for reasons of power system security and operation.

[10] AEMO, Interim Arrangements for Utility Scale Battery Technology.

For an ESS that is connected to the grid, a registered participant has a single connection agreement with the NSP and a performance standard for the asset. In accordance with the NER, the performance standard identifies the agreed technical performance associated with their generating systems and scheduled loads at a relevant connection point. In assessing an application for registration as a Generator, AEMO must be satisfied that the generating system is capable of meeting or exceeding applicable technical performance standards.[11] The NER technical obligations for generating systems are more onerous than those for loads.

Performance standards are one of the principal tools AEMO uses to manage power system security, and are established between AEMO, the NSP and connection applicant during the connection process.[12]

Central dispatch arrangements

For an ESS, a Market Customer and Market Generator may apply to AEMO to aggregate its scheduled load and scheduled generating units respectively.

NER clause 3.8.3 does not allow a registered participant to aggregate generating units, scheduled loads and scheduled network services with each other, e.g. a scheduled generating unit and scheduled load cannot be aggregated.

In its capacity as Market Generator and Market Customer, the ESS operator must submit a dispatch offer and bid in respect of its scheduled generating unit and scheduled load, respectively[13]. To cater for these separate requirements, AEMO's market systems require two separate DUIDs. The registered participant is responsible for:

- Managing its separate bids and offers for each asset to ensure the ESS does not simultaneously receive a dispatch target to both consume and produce electricity.
- Describing its FCAS capability separately for each of the ESS DUIDs (those reflecting consumed and produced electricity) so the combination of both provides information about the physical headroom possible.

Under this arrangement, an ESS operator can provide both energy and FCAS as a Market Generator and, separately, as a Market Customer if the Market Ancillary Services Specification (MASS) requirements are met and AEMO approves its application to do so. It may also be eligible to provide non-market ancillary services if it meets the relevant requirements.

Metering and settlements arrangements

The NER requires:

- Each connection point has a single financially responsible Market Participant (FRMP).
- Each connection point has a NER compliant metering installation.
- Each metering installation has a unique national metering identifier (NMI)[14].
- A registered participant has a connection agreement with the local NSP for the connection point.

An ESS is connected to the grid through one connection point and, currently, the same person is financially responsible for the connection point but typically registered in two Market Participant categories. Although an ESS has one NER-compliant metering installation, AEMO must create two NMIs to deal with the consumption (load) and production (generation) from an ESS – one is a 'dummy NMI' for system purposes.

[11] Refer to NER clause 2.2.1(e)(3).
[12] Where appropriate, a performance standard includes technical requirements for load and generation.
[13] Refer to NER clause 3.8.6 and 3.8.7.
[14] Refer to NER clause 7.2.1 and 3.15.3

Separate marginal loss factors (MLFs) are typically applied in dispatch and settlements to the load and generation, determined in accordance with AEMO's Forward Looking Loss Factor Methodology.

Figure 1 illustrates a stand-alone battery system and Table 1 sets out the key NEM requirements for the battery system.

Figure 1 Stand-alone battery system

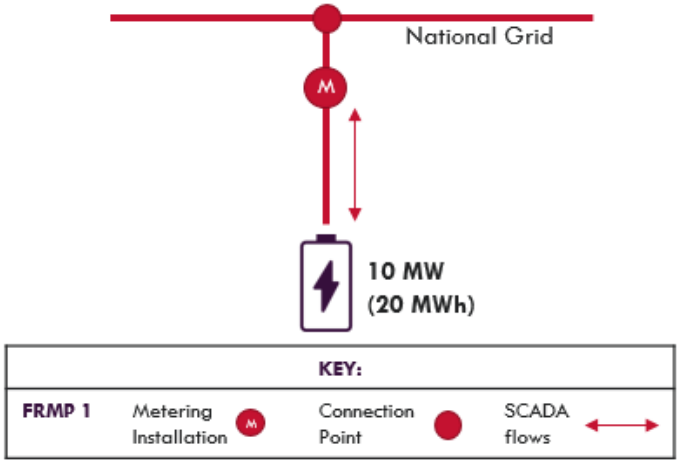


Table 1 Summary of key NEM requirements for a stand-alone battery system

Registration	Central dispatch	Metering	Settlements and prudentials	Marginal loss factors	Performance standard
• **Generator, classifies as Market Generator and as a scheduled generating unit.** • **Customer, classifies as Market Customer and market load/ scheduled load.**	• Separate offer (scheduled generating unit). • Separate bid (scheduled load). • in AEMO market systems, represented by two unlinked DUIDs.	One metering installation required, must be capable of metering the load and generation.	• AEMO will settle the load and generation at the connection point. • Maximum credit limit will be calculated for Market Generator and Market Customer separately, then netted to calculate any credit support required.	Separate marginal loss factors for the load and generation.	Single performance standard, which covers load and generation.

2.4.2 'Hybrid' facility arrangements

Under the NEM arrangements, a proponent seeking to register and operate co-located ESS with generation or load must do so under both the Generator and Customer registered participant categories.

As for a stand-alone ESS, an ESS co-located in a 'hybrid' facility will be subject to the interim arrangements for stand-alone ESS and existing NER requirements for generation or load resources.

Similar to a stand-alone ESS, to participate in central dispatch, a registered participant bids each asset[15] into the market, unless its assets have been aggregated. Under the NER, a Scheduled Generator, Semi-Scheduled Generator or Market Participant can aggregate their relevant generating units, scheduled network services, or scheduled load respectively[16]. The NER does not allow aggregation of generating units with a market load for energy or market ancillary services. Consequently, AEMO systems do not currently support aggregation of different resource types.

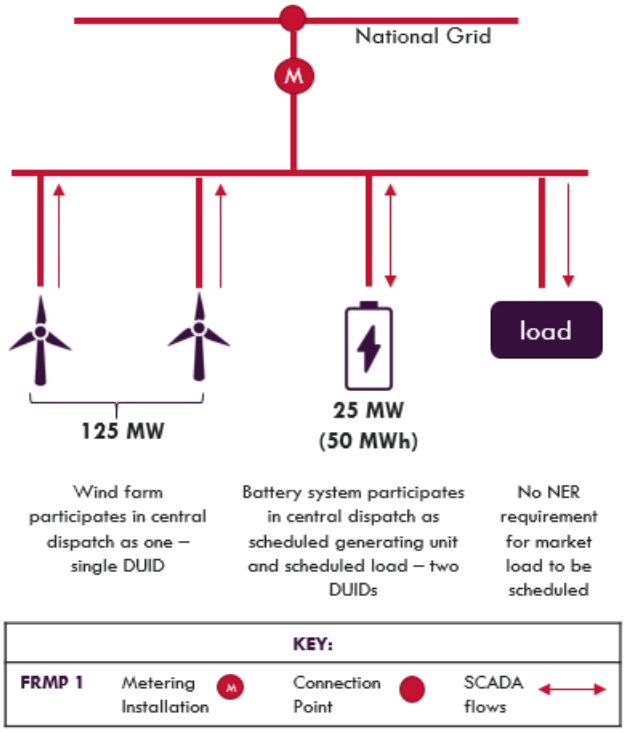
Each asset in a 'hybrid' facility will have separate DUIDs, with the ESS having two DUIDs – one for load and the other for generation. Aggregated assets participate in central dispatch using one DUID. Where relevant, separate MLFs are typically applied in dispatch and settlements where there is both load and generation at the connection point to the grid.

Therefore, and similar to the arrangements for an ESS, the generation and load must be treated separately.

Under this approach, a proponent has several options to register and connect, depending on their operational needs.

Figure 2 illustrates a 'hybrid' facility with ESS (a battery system), generation, and load. Table 2 sets out the key NEM requirements including the typical way this 'hybrid' would be registered under the existing registered participant categories.

Figure 2 'Hybrid' facility



[15] For example, scheduled generating unit, semi-scheduled generating unit or scheduled load.

[16] Refer to NER clause 3.8.3.

Table 2 Key NEM requirements for a 'hybrid' facility

Registration	Central dispatch	Metering	Settlements/prudentials	Marginal loss factors	Performance standard
Generator, classifies as Market Generator: • Wind as semi-scheduled generating units and aggregated under NER clause 3.8.3. • Battery as a scheduled generating unit. Customer, classifies as Market Customer: • Battery as market load/ scheduled load. • Market load, does not need to be scheduled.	• Wind farm – submits one offer, represented by one DUID in AEMO market systems. • Battery – submits separate offer (scheduled generating unit) and bid (scheduled load), represented by two unlinked DUIDs in AEMO market systems.	One metering installation required at the connection point, must be capable of metering the load and generation.	• AEMO settles the load and generation at the connection point. • Maximum credit limit will be calculated for Market Generator and Market Customer separately but will be aggregated for any credit support required.	• Separate marginal loss factors for the load and generation.	• Single performance standard, applicable at the connection point.

2.4.3 Exempt generating units and ESS

As set out in section 2.4.1, AEMO may exempt a person from the requirement to register a generating system. Under AEMO's Guide to Exemptions and Classification of Generating Units (Registration Exemption Guide) a person who owns, controls or operates a generating system less than 5MW is automatically exempt from registration[17]. This applies to battery systems less than 5MW as these are currently treated as generating units. Under this guide and the Battery Interim Arrangements the electricity consumed to charge a battery system less than 5 MW may by treated as auxiliary supply.

Under the NER, exempt generating units are defined as small generating units and a MSGA may classify these to provide energy and access to the spot price. There are no explicit provisions in Rule 2.3A that prohibit an SGA from classifying ESS that is treated as a small generating unit. Similarly, the NER does not expressly state that a Market Customer (typically a retailer) can provide the export from an ESS or generating unit behind the connection point.

For both categories, the NER does not limit the number of small generating units in their portfolio, or limit the aggregated MW response that can be provided. AEMO has no oversight of these small generating units and they effectively act as 'non-scheduled' generation in the NEM.

2.4.4 NER non-energy recovery arrangements

Under the NER, AEMO is responsible for the power system being operated in a safe, secure, and reliable manner. To fulfil this obligation, AEMO controls key technical characteristics of the power system (such as

[17] Refer to AEMO's website, see: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Participant-information/New-participants/Exemption-and-classification-guides.

frequency and voltage) through various market and non-market ancillary services and regulatory mechanisms.

Under Chapter 3 of the NER, AEMO recovers these services' payments or compensation payments from relevant registered participant categories. Any settlement shortfall that occurs would result in registered participants who are owed monies being paid less than they were otherwise owed.

Table 3 identifies all NEM non-energy recoveries, with the registered participant category they are recovered from and relevant NER clauses.

Table 3 Current NEM non-energy settlement recovery

	Cost recovery from	NER Reference
Market ancillary services		
FCAS – contingency raise	Market Generators, MSGAs	3.15.6A(f)(3)
FCAS – contingency lower	Market Customers	3.15.6A(g)(3)
FCAS – regulation	Market Generators, MSGAs and Market Customers on causer pays basis	3.15.6A(i)
Non-market ancillary services		
Network support control ancillary services (NSCAS)	Market Customers	3.15.6A(c2)(1)
System restart ancillary services (SRAS)	Market Customers, Market Generators, MSGAs	3.15.6A(c2)(2)
Interventions		
Direction – energy	Market Customers	3.15.8(b)
Direction – FCAS	Market Customers, Market Generators and MSGAs on a causer pays basis	3.15.8(f)
Direction – other	Market Customers, Market Generators, MSGAs	3.15.8(g)
Mandatory restrictions	Market Customers	3.12A.7(e)
Reliability and emergency reserve trader (RERT)	Market Customers	3.15.9(f)
Affected Participant Compensation	Scheduled Generator, Scheduled Network Service Provider, Market Customer	3.12.2
Market suspension	Scheduled Generators, Ancillary Service Providers	3.14.5A
Other events		
Market shortfall and surplus	Market Generators, MSGAs	3.15.22, 3.15.23
Administered price cap or administered floor price compensation Payments	Market Customers	3.15.10(a)

For market settlement and calculating non-energy recovery amounts, AEMO uses net meter data ('N' datastreams) for each trading interval and financially responsible Market Participant. The net meter data provides an energy value for settlement, fees and recovery calculations for all registered participant categories. This arrangement has been in place since NEM start and, in terms of the NER, appears to be

reflected in the use of the adjusted gross energy (AGE) in various settlement formula. The energy value used by AEMO is either a positive or negative amount, which is adjusted for a distribution loss factor.

For ESS, a separate AGE is calculated for the Market Customer and Market Generator. This results in non-energy recoveries for ESS being calculated based on the consumed and sent out energy, not net meter data. In contrast, where a Market Generator, Market Customer or MSGA has both consumed and sent out energy occurring at a relevant connection point, the energy value is netted, and non-energy recovery is calculated on either a positive or negative energy amount.

2.4.5 NEM Participant fees and charges

Under NER Rule 2.11, AEMO determines Participant fees to cover its budgeted revenue requirements associated with fulfilling its functions. AEMO fees and charges need to reflect the cost of participating in the NEM. Typically, AEMO determines the participant fee structure every five years[18].

For an ESS registered participant, AEMO fees and charges are currently recovered based on:

- Market Customer for consumption (variously referred to as load or customer energy in the NER).
- Market Generator for sent out generation.

For Market Customers and Market Generators (that are not ESS operators), AEMO bases the calculation of Participant fees on the absolute net energy amount. If a significant portion of a Market Customer's market load connection points have exempt generating units (behind the connection point), the calculation of participant fees is based on the net consumption (load less generation). Where the generation is larger than load amount, the fees are based on the net metered amount (generation less load). Where generation and load are equivalent, no fees are paid. Table 4 sets out the Participant fees for specific functions AEMO has under the NER. In addition, AEMO recovers the cost of new registrations through fees determined for each registration category[19].

Table 4 Recovery of Participant fees and charges

Fees and charges	Cost recovery from
General (unallocated)	Market Customers
Allocated direct costs	Market Customers (54%) Market Generators, MSGAs, Market Network Service Providers (46%)
Energy Consumers of Australia	Market Customers
Full Retail Competition	Market Customers (with a retail licence)
National Transmission Planner	Market Customers, MSGAs
Registration fees	Proponents registering
Participant Compensation Fund	Market Generators (Scheduled and Semi Scheduled)

[18] AEMO Final Report – Structure of Participant fees in AEMO's Electricity Markets 2016 at: https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/Structure-of-Fees/Final-Report--Structure-of-Participant-Fees-in-AEMOS-Electricity-Markets-2016-170316.pdf

[19] AEMO 2019-20 Budget and Fee Schedule at: http://aemo.com.au/-/media/Files/About_AEMO/Energy_Market_Budget_and_Fees/2019/FY20-Final-AEMO-Electricity-Revenue-Requirement-and-Fee-Schedule.pdf

TUOS and DUOS charging arrangements

Network Service Providers (NSPs) are subject to economic regulation and receive a regulated rate of return for the network assets that provide standard shared network services to those connected to the NSP's network, including for the costs associated with augmentation, replacement, operating and maintenance costs. Currently TUOS and DUOS arrangements are covered by a combination of instruments, including the NER and Australian Energy Regulator (AER) regulatory determinations. These instruments identify who pays for NSP shared network services, and how much.

The AER-approved revenue requirements of Transmission Network Service Providers (TNSPs) and Distribution Network Service Providers (DNSPs) are recovered from users through a range of charges including:

- TUOS from Transmission Network Users for the provision of prescribed transmission services and prescribed common transmission services as defined in the NER, subject to an individual NSP pricing methodology approved by the AER.
- DUOS from Transmission Customers (Customers, Non-registered Customers and DNSPs) and Network Users for the provision of direct control services.

It is a feature of the NEM's design that Generators do not pay directly regulated TUOS or DUOS charges, however they do pay negotiated charges for costs directly associated with establishing and maintaining their connection to a transmission or distribution network.

3. STATEMENT OF ISSUE

3.1 ESS approach

As set out in section 2.2, under the current regulatory framework, a single ESS (e.g. battery system or pumped hydro system) is treated as two separate components because an ESS is not defined in the NER. An ESS participates in the NEM as both a load and generating unit since it consumes electricity to store for later use (either to send to the national grid or for local use). The existing regulatory model only allows non-network connection assets to be classified as load or generation, by a Generator or Customer respectively, which assumes a single direction of power flow all or most of the time.

While AEMO has been able to accommodate ESS under interim arrangements, there are a number of challenges using the current approach to the treatment of ESS under the existing regulatory framework (including rules, procedures and systems) that leads to:

- Lack of clarity in the NER for proponents regarding how to register and participate in the NEM. Currently, ESS proponents need to refer to various AEMO explanatory guidelines and factsheets to understand how their facilities may participate in the NEM. Complicated registration and participation arrangements results in proponents and AEMO spending time and resources understanding and putting systems and practices in place to manage these arrangements.
- Increased operational complexity and inefficiency involved in treating a single asset as two components. In particular, requiring a Registered Participant with an ESS (which has two DUIDs, one for load and one for generation) to:
  - Submit separate energy bids and offers for the scheduled load and scheduled generating unit, which could result in simultaneous dispatch of the load and generation.
  - Submit separate FCAS offers for the ancillary service load and ancillary service generating unit. The combined offers need to reflect the overall capacity to move from load to generation and vice versa.
- Technical requirements (applicable at the grid connection point) that are not symmetrical for the same asset, e.g. ramp rates.
- Complicated IT arrangements for registered participants and AEMO.
- Difficulty for AEMO and other parties understanding and analysing market data, because it is necessary to reference two separate DUIDs to understand the operation of the single asset (ESS).
- Uncertainty regarding the application of fees and TUOS and DUOS charges, and non-energy recovery due to the consumed electricity for an ESS being treated as a market load. In submissions to the AEMC's CoGATI, stakeholders have raised the uncertainty of TUOS charges as a key issue for ESS proponents.
- Insufficient information provided on the energy limited capacity reserves of an ESS. Battery systems are of particular concern since they can charge and discharge quickly and cycle a number of times a day and they typically rebid regularly. Currently, these are not optimised in pre-dispatch and PASA due to the NER not recognising and specifying any requirements for these assets. This lack of information might result in less informed decision-making for:
  - Registered participants, as pre-dispatch information is less accurate.
  - AEMO when managing power system security and reliability, e.g., if ESS capacity is not known in a certain timeframe, it cannot be relied on when assessing system reserves and may result in AEMO underestimating available reserves and, for example, inefficiently intervening. Alternatively, relying

on ESS capacity when energy limits are not accurate could lead to AEMO overestimating available reserves and not taking action early enough.

Of the 20 public submissions AEMO received in response to the EGES Stakeholder Paper and the proposal therein, the majority of stakeholders indicated support to clarify the NER arrangements for ESS and AEMO's proposed model.

3.2 Hybrid facilities

Further to the issues identified for ESS in section 3.1, the way in which a proponent with a 'hybrid' facility registers and participates in the NEM is difficult to establish. Some of the challenge arises out of the assumption underlying the original NER that there is a one-to-one relationship between a registered participant category and an asset type (including the technology type) provided. For example, a Generator is either a Scheduled Generator (which was designed for synchronous generating units) or Semi-Scheduled Generator (which was designed for asynchronous generating units, wind or solar). The rights and obligations in the NER cannot always be readily applied to the 'hybrid' facility configurations increasingly being proposed.

Since the NER were not drafted with a view to 'hybrid' configurations, AEMO has to interpret the rules to accommodate these facilities in the regulatory framework and systems, sometimes needing to work with proponents almost on a case-by-case basis as unique differences emerge. While AEMO and proponents have generally been able to resolve application issues to date, the increasing number and diversity of 'hybrid' facilities means it is desirable to improve the clarity of the NER, and the associated procedures and systems, to explicitly recognise 'hybrid' facilities.

Also, under NER Chapter 5 technical requirements are based on the registered participant category, instead of the asset. Performance standards that apply to a Customer's load are less onerous than a Generator's generating system, reflecting the assumption that load would play a passive role in the NEM. Where a registered participant has a 'hybrid' facility including a load, the load is not passive and can be controlled (the entire facility is likely to be operated with one control system). It is necessary for AEMO to have greater visibility of all assets in a 'hybrid' facility to ensure AEMO understand the impact these facilities have on the power system.

AEMO considers that it is no longer appropriate to base performance standards on the registered participant category as we are expecting to see more ESS and 'hybrid' facilities. A registered participant's performance standard should be based on its assets.

Further, since the NER currently requires a single metering installation at each connection point it is challenging to determine the energy flows occurring between individual assets in 'hybrid' facilities to calculate fees, charges or non-energy cost recoveries for separate energy flows an individual asset. For example, if the policy is for an ESS to be exempt from TUOS charges (as proposed in section 4.2.3) and the 'hybrid' facility includes a load, battery and generating unit, the load's consumption from the national grid is impossible to determine on the basis of the metering data from a single metering installation at the connection point. Further consideration of the appropriate metering arrangements for 'hybrid' facilities is needed to prevent any perverse incentives for the co-location of assets (particularly loads in 'hybrid' facilities with ESS) or Registered Participants switching between categories to avoid obligations. Some questions to be considered:

- Are further requirements needed, for example should each asset in a 'hybrid' facility be required to have revenue meters or is supervisory control and data acquisition (SCADA) data appropriate?
- Can the policy option be implemented and is this consistent across the calculation of fees, charges or non-energy cost recoveries?

The AEMC may also need to consider whether further requirements need to be in place to ensure these processes operate efficiently and consistently across the NEM.

3.3 NER non-energy cost recoveries

The recovery of non-energy services is based on causer or beneficiary pays principles. As a person with an ESS is typically registered as a Market Customer and Market Generator, current recovery of the cost of non-energy services from that person is based on the consumed electricity ('E' datastream) and the sent out electricity ('B' datastream) occurring in a trading interval[20]. For example, in a 30 minute trading interval where FCAS regulation services are used:

- If an ESS is only consuming electricity, recovery from the relevant Registered Participant would be based on the 'E' datastream.
- If an ESS is consuming and producing electricity, recovery from the relevant Registered Participant would be based on the 'E' and 'B' datastreams.

AEMO considers that this approach is consistent with causer or beneficiary pays principles since it ensures that a Registered Participant who contributes to the need for a service would be recovered from based on what they do in the corresponding period. This approach best reflects and places a value on a Registered Participant's contribution when non-energy services are needed. AEMO considers this approach should continue to apply to the proposed new Bi-directional Resource Provider, who would have a bi-directional electricity flow at their connection point.

Under the current NEM arrangements for ESS described in Sections 2.4.1 and 2.4.3, the NER does not prohibit an MSGA from classifying an ESS with a nameplate rating of less than 5 MW, since under the existing NEM arrangements it is treated as a generating unit. In this circumstance, the electricity consumed by the ESS is treated as auxiliary supply. There was no expectation that an MSGA might predominantly export electricity to the grid in some periods, hence NER non-energy cost recovery provisions do not contemplate recovery from an MSGA based on its consumed energy. This is a NER gap and should be addressed if MSGAs are to continue to be able to classify exempt ESS as proposed (refer to section 4.1).

A further issue is that, since NEM start, AEMO has calculated non-energy cost recoveries based on net metering data. However, using the net energy amount for a Registered Participant registered in a single category with significant counter-flows can cause the following perverse outcomes:

- It reduces the amount being recovered, e.g. a Market Customer (retailer) with significant generation behind the market load connection points has recovery reduced compared to the outcome of generation and load at separate connection points.
- It can lead to payment being made to those Market Customers rather than recovery from them; if the sent out energy exceeds consumed energy, some payments would be made to the registered participant based on the net export[21].

For a Market Generator and MSGA, any consumed electricity is considered auxiliary supply and this consumed electricity is ignored for non-energy cost recovery.

Under the current NER recovery approach, an MSGA that has ESS in its portfolio may avoid paying appropriate non-energy cost recovery amounts since the electricity flows at the connection point are bi-directional and could be netted as AEMO uses net metering data for a given interval to calculate the energy value. AEMO considers it necessary that the NER clearly provide for non-energy cost recovery from MSGAs to be based on their consumed and sent out energy, in the same way as is proposed for a Market

[20] Refer to Table 1 in AEMO's MSATS Procedures National Metering Identifier for information on datastream suffixes for interval metering data.

[21] For example, in clauses 3.15.6A(o) (ancillary service recovery) and 3.15.8(h) (directions compensation), the sent out energy amount assessed for recovery from Market Generators and MSGAs has a floor of zero, so they cannot receive payment if there is net consumed energy in a trading interval. There is no corresponding floor for consumed energy amounts.

Bi-directional Resource Provider. AEMO recognises this non-energy cost recovery approach would impact MSGAs that do not have 'exempt' ESS in their portfolios and, under AEMO's proposed rule, any auxiliary supply (which is consumption) occurring in a relevant trading interval would be subject to non-energy cost recovery.

The same principle applies to all bi-directional connection points, including those a Market Customer or Market Generator is financially responsible for. While this rule change proposal does not specifically seek to address these registered participant categories' non-energy cost recoveries, AEMO considers it appropriate to consider this soon.

If non-energy cost recoveries are not based on consumed and sent out energy flows in the same way for all registered participant categories, this may:

- Provide incentives to register in certain registered participant categories to avoid the financial cost of non-energy services, and potentially other services like DUOS.
- Result in the burden of non-energy services being borne by customers that cannot afford to own and connect 'exempt' generating units or ESS behind their connection point. This impost would be made worse if the base of registered participants to recover from diminishes further.

3.4 TUOS and DUOS arrangements

Uncertainty over the recovery of TUOS and DUOS arrangements for ESS arises because the proponents of these assets are currently required to register as a Market Customer and Market Generator in the absence of recognition of ESS in the NER. Since Market Customers are typically charged TUOS and DUOS for their consumed electricity, each NSP needs to consider whether it must recover TUOS and DUOS charges from ESS proponents in a manner that is consistent with the relevant NER provisions in Chapter 6 or 6A.

The NER should clarify whether TUOS and DUOS is to be charged for ESS. The current ambiguity results in NSPs and proponents interpreting the rules and implementing charging arrangements individually for ESS in their network. If this is not clarified different arrangements may be implemented across the NEM, potentially creating perverse incentives for locating ESS in some regions or to configure facilities for the purpose of defeating any charging requirements rather than in a way that reflects efficient outcomes. Proponents need certainty in this area to understand the ongoing costs of their business models.

3.5 ESS integration drafting and other issues

The following section identifies issues with respect to key NER terms and other changes AEMO considers needed to integrate grid-scale ESS into the NEM.

3.5.1 ESS integration drafting

In considering how to integrate ESS and 'hybrid' facility concepts into the NER, it is apparent that all of the rights and obligations in the NER that currently relate to Generators, Customers and MSGAs need to be opened up to incorporate the concept of bi-directional assets. Because the market and scheduled registered participant categories are currently based on the operation of specific assets rather than the activity of producing or consuming power in relation to the grid, drafting will remain relatively cumbersome.

Recognising the scope of the changes, AEMO has proposed suggested definitions in relation to the Bi-directional Resource Provider registration category and ESS, and the restructuring of established terms in the NER, with a view to containing the overall amount of change and clarifying the rights and obligations that also apply to market participation.

AEMO identified there are terms in the NER that:

- Are technology specific e.g. 'generate', 'generated', 'sent out generation'.
- Are used both to identify a type of asset and indicate a quantity of flow in a particular direction, like 'load' and, to a much more limited extent, 'generation'.
- Could be removed or replaced to simplify and facilitate greater understanding of the NER.

To integrate bi-directional electricity flows, AEMO considered that new terms were needed to reflect that registered participants either consume and/or produce electricity (irrespective of the nature of those assets) at the connection points they are financially responsible for. In general terms, AEMO has proposed concepts of:

- 'Consumed electricity' to represent a quantity of electricity flowing from the network at a connection point, which replaces the term 'load' where it is used in that sense (rather than as an asset).
- 'Sent out electricity' to represent a quantity of electricity flowing to the network at a connection point, which replaces the term 'sent out generation'.
- 'Produced electricity' to represent a quantity of electricity produced by a generating unit or bi-directional unit as measured at its terminals, which replaces the term 'generation' (noting measurement could be deemed to be at the connection point, so equivalent to sent out).

AEMO acknowledges that there are alternative drafting options to the task of integrating ESS. AEMO has prepared a detailed drafting proposal for Chapters 2, 3 and 10 of the NER to demonstrate an approach that it considers is workable and can simplify the application of the rules to Bi-directional Resource Providers in addition to the existing registered participant categories. In addition, AEMO has set out drafting principles for integrating ESS and 'hybrid' facilities under Chapters [4, 5, 6, 6A, 7 and 8,] together with suggested transitional provisions for existing ESS in Chapter 11.

3.5.2 Ramp rates and aggregation

Like other scheduled assets, ESS must have ramp rates applicable for the consumption and production-side. Under the current NEM arrangements the minimum ramp rate requirement for an ESS are:

- Scheduled load that is not aggregated has a minimum 3MW/minute ramp rate[22].
- Scheduled generating unit is the lower of 3MW/minute or 3% of the maximum generation of the unit in MW/minute[23].

Under the NER definition of generating unit[24] (and by extension ESS), a unit must be capable of functioning as a single entity to produce electricity. Typically this occurs at the inverter for both semi-scheduled generating units and battery ESS, so it would be logical for the same aggregation and ramp rate regime to apply to (scheduled) ESS. Typically, it would be impractical to register and classify each of these generating units, hence the NER allows a registered participant to aggregate and dispatch them as one unit.

Different aggregation methods can result in different minimum ramp rates calculated for semi-scheduled generating units and bi-directional units, as set out in Table 2.

[22] Refer to NER clause 3.8.3A(b)(1)(ii).
[23] Refer to NER clause 3.8.3A(b)(1)(iv) and Chapter 10 definition of generating unit minimum ramp rate requirements.
[24] Defined as "The plant used in the production of electricity and all related equipment essential to its functioning as a single entity."

Table 2 Ramp rate and aggregation scenarios

Scenario	Relevant NER clause	Requirement	Calculation	Minimum ramp rate
4 * 8 MW semi-scheduled generating units or scheduled ESS	2.2.7(i)	• Not able to aggregate under Chapter 2 due to 6 MW threshold and would be aggregated under NER rule 3.8.3	Generation – 32 MW * 3%/min = 0.96 MW/min (rounded to 1)	1 MW/min
	3.8.3 and 3.8.3A(b)(1)(iii)	• Aggregated under NER rule 3.8.3 • Generating unit - the sum of 3% or 3MW/min, whichever is lowest, for each individual generating unit [25] • Load (ESS only) – the product of 3MW/minute and the number of individual scheduled loads[26]	Individual generating unit – 8 MW * 3%/ min = 0.24 MW/min (rounded to 1) Generation – 4 * 1 MW/min = 4 MW/min Load – 4 * 3 MW/min = 12 MW/min	Generation – 4 MW/min Load – 12 MW/min
40 * 0.8 MW semi-scheduled generating units or Scheduled ESS	2.2.7(i), aggregated	• Generating unit – 3% or 3 MW/min of the sum of the maximum generation, whichever is the lowest	Generating unit (aggregated) – 32 MW * 3%/min = 0.96 MW/min (rounded to 1)	Generating unit – 1 MW/min
	3.8.3 and 3.8.3A(b)(1)(iv)	• Generating unit (aggregated) - the sum of the minimum ramp rate requirement for each individual generating unit[27] (3% of maximum generation or 3 MW per minute, whichever is the lowest) • Scheduled load (ESS only) – the product of 3MW/minute and the number of individual scheduled loads[28]	Individual generating unit – 0.8 MW * 3%/min = .024 MW/min (rounded to 1) Generating unit (aggregated) – 40 * 1 MW/min = 40 MW/min Scheduled load – 40 * 3 MW/min = 120 MW/min	Generating unit – 40 MW/min Scheduled load – 120 MW/min

To ensure an appropriate ramp rate can be calculated for an ESS, the appropriate aggregation method needs to be considered. As set out in Table 2 the existing aggregation and ramp rate calculation requirements could result in inequitable and absurd outcomes. For example, a facility with 40*0.8 MW semi-scheduled generating units aggregated under:

- NER clause 2.2.7(i) would have a minimum ramp rate of 1 MW/min.
- NER clause 3.8.3 would have a minimum ramp rate of 40 MW/min.

Given that this issue also impacts semi-scheduled generating units, AEMO considers it appropriate to adopt a single, consistent aggregation and ramp rate method for ESS, semi-scheduled generating, and scheduled generating units. The key differences between the aggregation requirements under NER clauses 2.2.7 and 3.8.3 is that clause 2.2.7(i) includes a requirement for aggregated semi-scheduled units to have similar energy conversion models, and individual units 6 MW or above cannot be aggregated.

[25] Refer to the generating unit minimum ramp rate requirement, paragraph (b).
[26] Refer to NER clause 3.8.3A(b)(1)(ii).
[27] Refer to the generating unit minimum ramp rate requirement, paragraph (b).
[28] Refer to NER clause 3.8.3A(b)(1)(ii).

AEMO is unable to identify a continuing rationale to apply a 6 MW maximum threshold to the aggregation of semi-scheduled generating units. Proponents have also questioned this threshold and the rationale for maintaining two aggregation approaches under the NER. These questions are increasingly relevant as proponents consider building semi-scheduled generating units that are larger than 6 MW, including tidal generation.

AEMO considers there should be one aggregation approach for semi-scheduled generating units and ESS, reflecting NER clause 3.8.3.

NER clause 3.8.3 also requires AEMO to approve aggregation of generating units if certain conditions are met. Since the NER were not drafted with a view to 'hybrid' configurations, including for different technology types (e.g. a solar farm and wind farm), participation in dispatch as an aggregated generating unit (one DUID) may not always be possible depending on the technology type. AEMO considers it is appropriate for the NER to allow AEMO the discretion to consider whether different technology types can be aggregated.

3.5.3 Mandatory Restrictions and intervention compensation provisions

On 15 August 2019, the AEMC published its Investigation into Intervention Mechanisms in the NEM Final Report, which recommended that the mandatory restrictions framework (NER rule 3.12A) be removed and AEMO submit a rule change proposal for this purpose[29]. Given this, AEMO has not proposed any drafting amendments to incorporate Bi-directional Resource Providers into NER rule 3.12A.

In addition, the AEMC's Final Report recommended AEMO submit several rule change requests in relation to the calculation and recovery of Affected Participant and scheduled load compensation payments resulting from AEMO intervention events (NER rule 3.12). AEMO needs to consider the AEMC's recommendations further and at this time is not proposing drafting amendments to incorporate Bi-directional Resource Providers into NER rule 3.12.

AEMO considers that a Bi-directional Resource Provider should be eligible for intervention compensation because it could be impacted by an AEMO intervention event, however further consideration is needed to determine the appropriate calculation and recovery method for this proposed new category. In particular, it will be necessary to consider different 'what-if' scenarios and (if relevant) transparent compensation measures depending on the composition of a bi-directional facility. Given the need to consider rule changes for intervention compensation, AEMO has not proposed drafting amendments to incorporate Bi-directional Resource Providers into NER rule 3.12 at this stage.

3.5.4 Retailer Reliability Obligation

AEMO has considered how Bi-directional Resource Providers should be accommodated in the Retailer Reliability Obligation (RRO) framework that came into effect on 1 July 2019. Currently, Part D of Chapter 4A identifies RRO 'liable entities' as Market Customers with an aggregate annual load in a relevant region of more than 10GWh.

Under existing arrangements, ESS (batteries and pumped hydro) will be RRO liable entities (subject to the energy threshold) where they are registered as Market Customers for the load component of their facility. However, because an ESS is likely to consume and store electricity when demand is low, and to produce electricity in periods of high demand, an ESS should be regarded as improving system reliability. The position for 'hybrid' facilities with ESS, generation and load is more complex, as it will not be clear whether they are contributing to improving reliability.

[29] Refer to AEMC's website: https://www.aemc.gov.au/market-reviews-advice/investigation-intervention-mechanisms-and-system-strength-nem.

AEMO considers that a Bi-directional Resource Provider should not be a liable entity under the RRO unless its facility includes a load. This approach means that end user loads remain within the RRO framework, as intended, without creating incentives to install ESS with a load to avoid the RRO obligation.

A liable entity's liable load is currently calculated at the connection point; this will need to be considered when accommodating hybrid facilities. As discussed in section 3.2, AEMO has identified there are challenges measuring the energy flows of assets within a 'hybrid' facility which need to be addressed. While there are potential solutions to these, if the policy is to recover RRO liabilities for the actual consumption of loads within 'hybrid' facilities instead of at the connection point, the rule will need to prescribe how the recovery mechanism will work.

3.5.5 Other integration issues

Table 3 sets out some additional changes in the proposed rule to address drafting issues AEMO identified when drafting changes to Chapters 2 and 3. Table 6 shows how these issues are proposed to be addressed.

Table 3 Other integration issues in the NER

Clause	Issue
2.2.1(c) and (d)	Note in paragraph (c) is incomplete and therefore inaccurate. Paragraph (d) only identifies that AEMO can exempt a person or class of persons from the requirement to register as a Generator for only a generating system or class of generating systems. This should also include generating units.
2.2.6(b), (e)(2), 2.3.5(b)(1), (e)(1A), (2)	Where occurring, the references should be to an 'applicant' since the person is not yet a registered participant.
2.2.6(d), 2.3.5(d), 2.9.1(c), and 2.9A.2(d)	These clauses require AEMO to deem an application as withdrawn if AEMO has not received all the necessary information or clarifications within 15 business days of AEMO requesting the information. It is more appropriate to allow AEMO the discretion to withdraw an application instead.
3.6.3(c)and (d)(1)	References to 'predominant load flows' is incorrect. These flows refer to NER clauses 3.6.3(b)(2)(A) and (B), which refers to consumed and sent out electricity.
3.6.5(4) and (4A)	"then" is duplicated.
3.8.4(c)(3)	Should refer to 'energy constrained scheduled generating units'.
3.8.5(b)	Repetitive and extraneous information. Requirement for off-loading prices in the generation dispatch offer is also incorrect, this information is not required.
3.8.6(c), (h)(3)(ii), (f), (h)(1) and (2), 3.12.2(2)	Duplicated use of terms.
3.8.7(m)	The reference to 'may' is incorrect. Other references in the clause refer to 'must'. Where a scheduled generating unit has an energy constraint it must indicate its daily energy availability.
3.7C, 3.8.10, 3.9.3D	Consistent with other provisions, new paragraphs have been included to allow AEMO to make minor and administrative changes to the Constraint Formulation Guidelines, EAAP Guidelines and reliability standard implementation guidelines without undertaking a Rules consultation.
3.8.17(c), 3.8.18(a)	Should refer to Scheduled Generator, not Generator.

Clause	Issue
3.8.21(d)	Dispatch instructions are not always issued using automatic generation control (AGC) system and not via an electronic display in the plant control room. For future proofing, the drafting should only refer to electronic communication.
3.13.3(a)(3)	Refers to 'Scheduled Generators' and Semi-Scheduled Generators', this is an error since only Market Participants can be suspended.
3.13.3(l2)	This clause misinterprets the requirements in S5.2.4, which currently only applies to 30MW+ generating systems, whether pre-or post-registration. Therefore, the requirement is not separate from a registered Generator's obligation and can be covered by slightly expanding 3.13.3(a).
3.13.3(l2)(5)	Transmission Network Service Provider is not italicised.
3.13.4(p)(5)	Inappropriate reference to "as measured by AEMO's telemetry system". The Market Participant's SCADA measures and AEMO receives via SCADA.
3.15.8(f)(2), 3.15.8A(g)(2), 3.15.10C(b)(7)(i), (c)(3)(iii)(B)	Delete 'TSRP', this is not defined.
3.15.8(f)(2)	Delete 'TRSP', this is not defined.
3.15.21(c2)(2)(ii)	Market Ancillary Service Provider omitted from the clause. Under the Ancillary Services Unbundling Rule 2016 this provision was to exclude retailers (Market Customers) only. Although it is unlikely that a MASP would incur liabilities, excluding them was not the intent.
3.8.18(e)	Reference to 'Market Participant' is incorrect, the obligation is only on Scheduled Generators.
3.8.20(g)	Reference to scheduled generating unit and semi-scheduled generating unit omitted.
3.8.20(i)	AEMO should make documentation on the operation of the pre-dispatch process available only to Market Participants.
3.8.20(j)(2)	This should refer to a unit instead of an entity.
3.8.20(k)	'Scheduled load' omitted.
7.4.1(e)	MSGA omitted from this clause.
dispatched load	Redundant definition, this is the same as scheduled load.
peak load definition	Definition is circular.

4. HOW THE PROPOSAL WILL ADDRESS THE ISSUE

4.1 How the proposal will address the issue

The proposed solution will address the issues associated with the current treatment of ESS and 'hybrid' facilities by:

- Defining and recognising bi-directional units (single or aggregated ESS units), and bi-directional facilities (ESS or 'hybrid' systems where flow can be in either direction at the connection point).
- Creating a new registered participant category in NER Chapter 2, termed a Bi-directional Resource Provider.

Exemptions from registration would be provided for in the same way as for generating systems under the current NER.

Depending on the plant within the bi-directional facility, a registered Bi-directional Resource Provider would be required to classify those assets as:

- Bi-directional units only, which would be classified as both scheduled and market and participate in central dispatch with a single dispatch bid (and DUID). This will simplify and reduce complexity for bidding and dispatch instructions for these assets, including simultaneous dispatch of the consumption and production-side.
- ESS with a combination of assets including a scheduled generating unit, semi-scheduled generating unit or load.
- Load and generating unit. This classification would also apply to ESS without the ability to transition linearly from production to consumption, meaning it cannot submit a single dispatch bid.

The proposed bi-directional unit definition is technology neutral to allow for different storage technologies, e.g. pumped hydro, batteries, flywheels, to be covered by the definition.

AEMO considers that this definitional approach will resolve the regulatory and operational uncertainty associated with the current arrangements. A person registered in this category would be classified as a Market Participant and could provide services (e.g. energy, ancillary services and others) from each classified asset in the bi-directional facility.

The rule change proposal would integrate the Bi-directional Resource Provider and the assets it provides into the NER. The integration requires an examination of all NER responsibilities, rights and obligations that currently apply to registered participants that operate generation or load, and ensuring their application to Bi-directional Resource Providers is clear. To reduce the amount of change required in this respect, AEMO has proposed drafting in the definitions and in Chapter 2 to the effect that for 'hybrid' facilities a Bi-directional Resource Provider is taken to be a Scheduled or Semi-Scheduled Generator, as applicable, in respect of its classified generating units in the 'hybrid' facility.

The proposed rule also clarifies that an MSGA can classify 'exempt' ESS to provide energy services (the status quo) and ensures that non-energy cost recovery will occur based on the consumed and produced electricity.

For NER Chapters 2 and 3, AEMO has provided drafting to integrate the Bi-directional Resource Provider and the assets it provides into the NER. Appendix B includes a summary of the key Chapter 2 and 3 changes that are proposed to apply to Bi-directional Resource Providers.

Additionally, AEMO is proposing drafting changes to the NER to ensure the terms used describe the electricity consumption or production by an asset, irrespective of the technology type. This reflects a technology neutral approach to defining the electricity flows. AEMO considers this will both reduce the

additional drafting that would otherwise be required to integrate of ESS, and will provide a starting point for future reforms as bi-directional flows become increasingly the norm.

If the proposed rule is made, AEMO would need to integrate these changes into existing applications, procedures, guidelines, processes and systems. AEMO has identified transitional arrangements to allow preparation for the integration to commence following the AEMC's draft determination. This is necessary to ensure market changes can be delivered in a timely way.

4.2 Options identified to address the issues

4.2.1 New registered participant category

Alternative options to AEMO's proposed Bi-directional Resource Provider category were explored in AEMO's EGES stakeholder paper and are summarised in Table 4[30]. These options would also allow an ESS to be integrated in the NER, however AEMO considers they do not provide the most efficient participation model since they do not cater for a 'hybrid' facility that includes load and generation.

AEMO believes the proposed registered participant category would allow proponents to register and operate most efficiently because it caters for a combination of business models involving bi-directional electricity flows under a single registration.

Table 4 Alternate options to create a new registered participant category

ID	Alternate options
1	New registered participant category for provision of an ESS only
2	Amend the Generator registered participant category to include an ESS
3	Amend the Market Customer registered participant category to include an ESS

4.2.2 Participation in central dispatch for an ESS

Where technically possible, AEMO proposes that an ESS should participate in central dispatch with a single dispatch bid that allows 10 price bands comprising either positive or negative band volumes. Some stakeholders have also indicated a preference for a 20 price and volume band ESS dispatch model, reflecting what they have under the current ESS arrangements and to provide greater bidding flexibility. AEMO is proposing ESS participate with 10 price and volume bands because this is equivalent to participation of existing scheduled plant. While an ESS operator may have more flexibility participating in dispatch with a 20 price and volume band model, this needs to be balanced against several factors including:

- Would this provide an ESS operator a competitive bidding advantage?
- Is it appropriate to have a different dispatch model for ESS and the level of complexity and cost this may introduce to stakeholder and AEMO bidding systems?
- Will the dispatch model will be fit for purpose for future market changes?

As mentioned in section 4.1, where a proponent wishes to register as a Bi-directional Resource Provider to classify a bi-directional unit with a non-continuous operating range, the bi-directional unit may need to participate in central dispatch with two DUIDs, instead of one DUID. While this is unlikely for most new ESS, AEMO has identified the following alternative registration and participation options to address this:

- Option 1 – a proponent registers as a Bi-directional Resource Provider and the ESS as scheduled generating units and scheduled loads that are a part of a bi-directional facility. The ESS would be ESS for market purposes and operate in dispatch as two separate DUIDs. All relevant NER obligations on the Bi-directional Resource Provider and individual unit classification would be applicable.
- Option 2 – a proponent registers as a Bi-directional Resource Provider and classifies the asset as scheduled generating units and scheduled loads that are a part of a bi-directional facility. All relevant NER obligations on the Bi-directional Resource Provider and individual unit classification would be applicable.
- Option 3 – a proponent registers as a Market Generator and Market Customer and classifies the ESS as scheduled generating units and scheduled loads respectively. All relevant NER obligations on the registered participant categories and individual unit classifications would be applicable.

AEMO considers that option 1 would provide the best outcome for proponents with an ESS that is technically incapable of linearly transitioning between consumption and production in a dispatch interval, and vice versa. This recognises these assets as bi-directional assets for market purposes (e.g. settlements), but recognises their technical constraints and for operational purposes.

The proposed rule also requires registered participants with an ESS to submit a dispatch bid that reflects their available MW capacity for each trading interval. This should necessarily reflect the 'energy limits' of an ESS, effectively the remaining stored energy capacity. An accurate availability profile is needed for pre-dispatch and is an input to other AEMO forecasting tools. Under current NER clauses 3.8.4(c)(3), 3.8.6(b) and 3.8.7(m), a dispatch bid for an energy constrained scheduled generating unit or scheduled load may (or must) specify a daily energy limit. While the proposed rule does not seek to change this approach for scheduled generation and load, AEMO is currently reviewing whether the PASA tools and processes are fit for purpose and this may result in subsequent rule changes.

Existing NER compliance provisions for scheduled generating units would also apply to ESS.

4.2.3 Fees, charges and non-energy cost recoveries

AEMO considered the following options for non-energy cost recovery, AEMO participant fees, and TUOS and DUOS charges for the Bi-directional Resource Provider and MSGA categories:

- Fees and charges based on consumed energy from the grid, treat in the same way as Market Customers.
- Fees and charges based on sent out energy to the grid, treat in the same way as Market Generators.
- Fees and charges based on the net energy (consumed energy less sent out energy, and vice versa) from and sent out to the grid, treat in the same way as Market Customers and Market Generators.

Participant fees and non-energy cost recoveries

AEMO proposes that the new Bi-directional Resource Provider and MSGA should pay non-energy cost recovery and NEM Participant fees and charges based on consumed and sent out energy to the grid for relevant trading intervals. For a registered participant with a battery (ESS), this is consistent with the existing NEM arrangements for non-energy cost recovery and Participant fees. For an MSGA, this means non-energy cost recovery would be based on their consumed and sent out energy, instead of netted export energy amount at the connection point.

AEMO considers that this approach is consistent with causer or beneficiary pays principles, since it ensures these registered participants would pay for services based on their contribution to the need to provide the service. AEMO notes that arrangements allowing registered participant's with exempt ESS (or generating units) to reduce paying appropriately for these services, may create a competitive advantage for those registration categories.

More broadly, and to ensure non-energy cost recovery occurs consistently for all registered participants, the AEMC may wish to consider whether it is also appropriate to recover non-energy costs from Market Customers and Market Generators in the same way as AEMO has proposed for Market Bi-directional Resource Providers and MSGAs. Both Market Generators and Market Customers can also have bi-directional energy flows at the connection points where they are financially responsible. Noting that the metering installation is at the grid connection point and therefore energy flows behind that point are used for consumption or storage.

If the proposed rule is made, AEMO will also need to consider appropriate registration fees for the Bi-directional Resource Provider registered participant category.

TUOS and DUOS charges

AEMO proposes that a Bi-directional Resource Provider should not be required to pay TUOS charges in respect of a bi-directional unit. A scheduled resource can be constrained off and should not be required to pay TUOS charges. AEMO's rationale is:

- NSPs would not increase the capacity of the shared network to provide unrestricted access to ESS. In effect, a scheduled ESS acts as a part of the supply chain. Not charging TUOS for an ESS will not increase charges to others.
- Irrespective of whether it is a stand-alone ESS or part of a 'hybrid' system connected to the grid, ESS is treated as a connecting asset subject to negotiated connection charges, in this way it is being treated in a similar way to a generating unit or system.

AEMO considers that there is a broader issue with network pricing arrangements for distribution and transmission networks that need to be reviewed. The AEMC indicated in the CoGATI Review that its preliminary position is consistent with AEMO's position, which was set out in the EGES Stakeholder Paper[31]. Further, the AEMC is considering components of TUOS charging arrangements as a part of its Coordination of Generation and Transmission Investment Implementation – Access and Charging Review[32].

As discussed in section 3.2, AEMO is aware the calculation of TUOS and DUOS for 'hybrid' assets will be challenging for NSPs since it will be difficult to determine the 'market load's' consumption from the grid. The AEMC may need to consider whether further arrangements need to be in place to ensure these processes operate efficiently and consistently across the NEM.

4.3 Description of the proposed Rule

The following changes are suggested to the NER. AEMO has also submitted a marked-up version of Chapters 2, 3 and 10 based on version 119 of the NER. This has been updated to include the following rules:

- Global Settlement & Market Reconciliation Rule that comes into operation on 6 February 2022.
- Enhancement to the Reliability and Emergency Reserve Trader Rule schedule 3 that came into operation on 2 May 2019.
- Intervention Compensation and Settlement Processes Rule, schedule 1 that came into operation on 30 May 2019.

In this section ESS is referred to as a 'bi-directional unit' and 'hybrid' facility as a 'bi-directional facility', respectively, which are the proposed terms for the NER.

[31] Refer to the AEMC's website, see: https://www.aemc.gov.au/sites/default/files/2018-12/Final%20report_0.pdf.
[32] Refer to the AEMC's website, see: https://www.aemc.gov.au/market-reviews-advice/coordination-generation-and-transmission-investment-implementation-access-and.

4.3.1 Chapter 2

Registration as a Bi-directional Resource Provider

The proposed Rule would:

- Create a new registered participant category, termed a Bi-directional Resource Provider, to allow a person to register and participate in the NEM with a bi-directional facility.
- Define a bi-directional facility, which may include:
  - Only bi-directional units, each classified as a scheduled bi-directional unit.
  - Bi-directional units each classified as scheduled, and generating units each classified as scheduled or semi-scheduled generating units, and/or load classified as scheduled load.
  - Generating units each classified as scheduled or semi-scheduled generating units, and load classified as market load or scheduled load.
- Require a person who engages in the activity of owning, controlling or operating a bi-directional facility that is connected to a transmission, distribution or embedded network to register as a Bi-directional Resource Provider unless exempt.
- Allow AEMO to exempt a person or class of persons from the requirement to register as a Bi-directional Resource Provider, in accordance with AEMO guidelines and subject to conditions AEMO deems appropriate, where AEMO considers this is not inconsistent with the national electricity objective.
- Require a Bi-directional Resource Provider to:
  - Obtain AEMO's approval to classify each asset in a bi-directional facility as indicated above. Except where a bi-directional unit is technically incapable of linearly transitioning between consumption and production in a dispatch interval, and vice versa, it would need to be classified as a scheduled generating unit and scheduled load.
  - Classify the bi-directional facility as a market bi-directional facility.
  - Obtain AEMO's approval to classify a bi-directional unit as an ancillary services bi-directional unit, if so desired.
  - Notify AEMO of the year the person expects a bi-directional facility to cease supplying electricity to the grid.
  - Demonstrate to AEMO's satisfaction that the bi-directional facility is capable of meeting its performance standards.
  - For a load within a bi-directional facility, the load has adequate communications and/or telemetry.
- Require AEMO to approve a request from a person to classify a bi-directional unit, within a bi-directional facility as scheduled if AEMO is satisfied that:
  - The data submitted is submitted in accordance with schedule 3.1.
  - There is adequate communications and/or telemetry for dispatch instructions and audit purposes.
  - The bi-directional unit is capable of transitioning linearly from consuming to producing electricity and vice versa in central dispatch.
- Require AEMO to approve a request from a person to classify a bi-directional unit as a scheduled generating unit and scheduled load if AEMO is satisfied that:
  - The data submitted is submitted in accordance with schedule 3.1.
  - There is adequate communications and/or telemetry for dispatch instructions and audit purposes.

  - The bi-directional unit is not capable of transitioning linearly from consuming to producing electricity and vice versa in central dispatch.
- Require AEMO to approve a request from a person to classify a generating unit as a scheduled generating unit or semi-scheduled generating unit within a bi-directional facility if the relevant requirements in NER clauses 2.2.2(b) or 2.2.7(c) respectively are met.
- Require AEMO to approve a request from a person to classify a market load within a bi-directional facility as a scheduled load if the requirements of NER clause 2.3.4(e) are met.
- AEMO's classification approval can include relevant terms and conditions and the applicant must comply with these.
- A Bi-directional Resource Provider is a:
  - Scheduled Bi-directional Resource Provider for scheduled bi-directional unit or scheduled load.
  - Scheduled Generator for a scheduled generating unit.
  - Semi-Scheduled Generator for a semi-scheduled generating unit.
- A Scheduled Bi-directional Resource Provider must operate its scheduled plant in central dispatch in accordance with Chapter 3.
- A Bi-directional Resource Provider is a Market Bi-directional Resource Provider for activities for its market bi-directional facility. A Market Bi-directional Resource Provider must sell all sent out electricity to and purchase all consumed electricity from the spot market and accept payments or make payments, respectively, from or to AEMO for that electricity at the relevant spot price.
- Allow a Market Bi-directional Resource Provider to apply to AEMO to classify its scheduled bi-directional unit as an ancillary services bi-directional unit.
- Require AEMO to approve an application to classify a scheduled bi-directional unit as an ancillary services bi-directional unit if it is satisfied that the scheduled bi-directional unit:
  - Can meet the requirements in the MASS.
  - Has adequate communications and/or telemetry for dispatch instructions and audit purposes.
- AEMO's approval to classify a scheduled bi-directional unit as an ancillary services bi-directional unit can include conditions, which the Market Bi-directional Resource Provider must comply with.
- A Market Bi-directional Resource Provider with an ancillary service bi-directional unit:
  - Must ensure the ancillary service bi-directional unit provides market ancillary services in accordance with central dispatch under Chapter 3 and the MASS.
  - Must sell the market ancillary services produced by the ancillary service bi-directional unit to the spot market in accordance with relevant provisions under Chapter 3.
  - Is not entitled to receive payment from AEMO for market ancillary services except where those market ancillary services are produced using an ancillary service bi-directional unit in accordance with Chapter 3 or directed under NER clause 4.8.9.
- A Market Bi-directional Resource Provider may classify the following within a bi-directional facility:
  - A generating unit as an ancillary service generating unit in accordance with NER clause 2.2.6.
  - A load as an ancillary service generating unit in accordance with NER clause 2.3.5.

Market Customer, market loads and scheduled loads

- Require AEMO to approve an application from a Bi-directional Resource Provider to classify a load as a scheduled load if the requirements of NER clause 2.3.4(e) are met and make subsequent amendments to NER rule 2.3.5.

Small Generation Aggregator

- Allow an MSGA to classify a small bi-directional unit as a market bi-directional unit and make subsequent amendments to NER rule 2.3A.1.

Integration or minor amendments

- Amend NER clause 2.2.1(a) to ensure that a person who owns, controls or operates a generating system connected to a transmission or distribution system must be registered by AEMO as a Bi-directional Resource Provider where the generating system is a part of a bi-directional facility.
- Amend NER clauses 2.2.2(e) and 2.2.7(g) to include that a Bi-directional Resource Provider is taken to be a Scheduled or Semi-Scheduled Generator for the purpose of activities relating to a scheduled or semi-scheduled generating unit it has classified.
- Amend NER clause 2.2.6 to allow a Market Bi-directional Resource Provider with a generating unit to provide market ancillary services and require them to apply to AEMO for its approval to classify the generating unit as an ancillary service generating unit.
- Delete NER clauses 2.2.7(i), (j), (k), (l) regarding aggregating semi-scheduled generating units under Chapter 2 and amend clause 3.8.3, refer to Chapter 3 changes.
- Amend NER sclause 2.4.1(a) and 2.4.2(c) to include a Market Bi-directional Resource Provider as a category of Market Participant.
- Amend NER rule 2.7 to allow a Bi-directional Resource Provider to be an Intending Participant.
- Amend NER rule 2.9.3 to allow a person who is required to register as a Bi-directional Resource Provider for a bi-directional facility to apply to AEMO for an exemption from the requirement to register if there is a relevant intermediary to be appointed.
- Amend NER rule 2.10 to:
  - Provide for the cessation of registration as a Bi-directional Resource Provider, or the termination of its classification of its scheduled units or loads.
  - Provide the AER a power to exempt a Scheduled Bi-directional Resource Provider from the requirement to notify the closure date of one of its scheduled bi-directional units or generating units in accordance with guidelines it has issued.
  - Include provision for AEMO to reject an MSGA's notice to terminate its classification of a small bi-directional unit as a market small bi-directional unit unless AEMO is satisfied of the applicable conditions.
- In NER rule 2.12, include Bi-directional Resource Provider, Scheduled Bi-directional Resource Provider and Market Bi-directional Resource Provider in the interpretation of references to various registered participant categories.

4.3.2 Chapter 3

The term dispatch offer wherever occurring is replaced with dispatch bid, which is redefined to refer to the dispatch of any scheduled plant. In considering the need to accommodate market submissions for bi-directional facilities relating to either the sale or purchase of electricity, AEMO reflected on the definitions

of dispatch bid and offer, and related terms. Where a distinction is made between the terms 'bid' and 'offer', it is generally understood that a person 'bids' to buy a commodity or service, and 'offers' to sell it, even though that is not how the terms are defined in the NER (they are asset-specific). In the NEM, however, it could be said that the dispatch of energy and ancillary services is a process where all participants effectively bid in order to be scheduled, whether buying or selling. It is noted that the single term 'rebid' applies to both bids and offers. Other markets offer limited comparison. The declared wholesale gas market uses 'bids' to apply to both scheduled injections (selling) and withdrawals (buying) from the market, while the gas short term trading market rules use both bids and offers, defined so as to specifically refer to withdrawal or supply respectively.

Network losses and constraints

- Amend NER clause 3.6.1(3)(ii) to include scheduled bi-directional units and specify scheduled generating units.
- Amend NER clause 3.6.3 to ensure a distribution loss factor also applies to embedded bi-directional units.
- Amend NER clause 3.6.3(b1) to include a Bi-directional Resource Provider and bi-directional unit.
- Amend NER clause 3.6.3(b)(3) to update that DLFs are to be used to determine 'adjusted consumed energy' and 'adjusted sent out energy' (proposed new terms).
- Amend NER clause 3.6.3(b1) to include that where reasonable costs of the DNSP are met, a Bi-directional Resource Provider or Small Generation Aggregator may request the DNSP calculate a site specific loss factor for a bi-directional unit up to 10 MW or 40 GWh per annum capacity.
- Amend NER clause 3.6.4 to include scheduled bi-directional units, scheduled plant includes all scheduled plant.

PASA

- Amend NER rule 3.7.1 to require AEMO to collect and analyse information from Scheduled Bi-directional Resource Providers.
- For MT PASA, amend NER rule 3.7.2 to require:
  - AEMO to prepare regional forecasts of electricity consumption which also exclude consumed electricity from bi-directional units, as currently excluded for pumped storage.
  - AEMO to adjust the regional forecast consumed electricity for consumed electricity from scheduled bi-directional units and delete the reference to 'load bidders' as it is superfluous.
  - Scheduled Bi-directional Resource Providers to provide PASA availability for each of their scheduled bi-directional units and weekly energy constraints.
  - AEMO to prepare and publish the following information each day:
    - 10% probability of exceedance (PoE) of peak consumption and the probable peak consumption adjusted for the consumed electricity from scheduled bi-directional units.
    - Aggregate bi-directional unit PASA availability to produce electricity for each region.
    - Aggregate production capacity calculated for each region to include the capacity from scheduled bi-directional units.
    - Aggregate production capacity that cannot be produced continuously for each region due to weekly energy constraints from scheduled bi-directional units.

- Include scheduled bi-directional units in the identification and quantification of when and where network constraints may become binding on dispatch. Also amend to include scheduled generating units and scheduled load, as network constraints are relevant to dispatched assets.

Energy Adequacy Assessment Projection

- Amend NER rule 3.7C, to ensure: the EAAP takes into account Generator Energy Limitation Frameworks (GELFs) that apply to scheduled bi-directional units.
- For preparation of the EAAP, require a Bi-directional Resource Provider to provide AEMO with updated GELF parameters and other information that supplements the data required by AEMO to study the scenarios defined in the EAAP Guidelines.
- Where relevant, the EAAP Guidelines take into account a Scheduled Bi-directional Resource Provider and scheduled bi-directional units.
- AEMO must provide Scheduled Bi-directional Resource Providers an estimate of the total energy availability of its scheduled generating units or scheduled bi-directional units for thr period of the EAAP.

Demand side participation information

- Amend NER rule 3.7D, to replace 'unscheduled generation' definition with 'unscheduled electricity' and also include the produced electricity from a small bi-directional unit. Make subsequent amendments to NER rule 3.7D to incorporate these.

Central Dispatch and Spot Market Operation

- Where relevant, include Scheduled Bi-directional Resource Provider, scheduled bi-directional units and ancillary service bi-directional unit to ensure central dispatch takes these into account and places the necessary requirements on the registered participant, including.
  - To participate in central dispatch under NER clause 3.8.2.
  - Allowing a Scheduled Bi-directional Resource Provider to aggregate its bi-directional units, generating units or scheduled loads under NER clause 3.8.3.
- Amend NER clause 3.8.3(b), to require AEMO to approve an aggregation application if the applicant is seeking to aggregate units of the same technology type and classification, and has similar energy conversion models. Noting that existing NER clause 3.8.3(c) allows AEMO to approve an application for aggregation if the conditions of NER clause 3.8.3(b) are not met and it does not materially distort central dispatch.
- Where possible, simplify and improve drafting as indicated in AEMO's marked-up Chapter 3, some examples in:
  - NER clause 3.8.1(b).
  - Wherever occurring, delete 'dispatch offers' and 'market ancillary service offers' and replace with 'dispatch bid' and 'market ancillary service bid'.
  - Wherever possible, replace specific terms to groups of registered participant categories (e.g. 'Scheduled Generators, Semi-Scheduled Generators and Market Participants') with a generic reference to 'Registered Participant' or 'Market Participant' as applicable. In each case it is clear which participant categories are covered because the provision specifically refers to the relevant classified assets.

  - Wherever possible, replace expanded references where a defined term already covers the meaning, e.g. 'generating units, scheduled network services and scheduled loads' can be replaced with 'scheduled plant'.

- In NER clause 3.8.3A, ensure ramp rate requirements are applicable to a Scheduled Bi-directional Resource Provider and scheduled bi-directional unit, including:
  - For a registered participant with an aggregated semi-scheduled generating unit or scheduled bi-directional unit under NER clause 3.8.3, require that the ramp rate for each unit be the lower of 3 MW/minute or 3% of the maximum produced electricity or consumed electricity (for a bi-directional unit).

- In NER clause 3.8.4:
  - Require a Scheduled Bi-directional Resource Provider to notify AEMO of their available capacity for any scheduled assets in its bi-directional facility, including for each trading day.
  - A MW capacity profile specifying the MW available for each trading interval of the trading day, this needs to reflect the consumption and production of the bi-directional unit.
- In NER clause 3.8.5, require changes to MW quantities and off-loading prices in the dispatch bids for bi-directional units and generating units are in accordance with the Spot Market Operations Timetable.
- In NER clause 3.8.6:
  - A new clause to make the dispatch bid requirements obligations of the relevant registered participant (Scheduled Generator, Semi-Scheduled Generator, Scheduled Bi-directional Resource Provider and Market Scheduled Bi-directional Resource Provider), enabling the requirements to be specified as relating to the relevant plant rather than the registered participant classification. Also include in NER rules 3.8.6A and 3.8.7.
  - Include dispatch bid requirements for scheduled bi-directional units:
    - For each trading interval, the dispatch bid must contain 10 price bands, which can be positive and negative and be in dollars and cents in MW, for both the consumption and production-side of the bi-directional unit.
    - For each trading interval, an up and down ramp rate needs to be specified.
  - For each trading interval, a dispatch bid for a scheduled bi-directional unit and semi-scheduled generating unit must specify a price for each band in dollars and cents in MWh. This is consistent with requirements for other scheduled assets.
  - For consistency with other requirements include for semi-scheduled generating units that a dispatch bid specifies a price for each price band in dollars and cent per MW.
- In NER clause 3.8.7A, where an Ancillary Service Provider submits a market ancillary service bid for an ancillary service bi-directional unit:
  - It must be capable of responding in a manner identified by the MASS.
  - The values in the market ancillary service bid must reflect the technical characteristics of the unit.
- In NER clause 3.8.9, allow a Bi-directional Resource Provider to submit a default bid for scheduled bi-directional unit and ancillary service bi-directional unit.
- In NER clause 3.8.10, require AEMO to determine constraints on scheduled bi-directional units and ancillary service bi-directional units resulting from planned network outages and all relevant sub-clauses.

- In NER clause 3.8.14, for dispatch under supply scarcity conditions, include valid dispatch bids for scheduled bi-directional units.
- In NER clause 3.8.16, specify for a scheduled bi-directional unit that if the MW quantity specified in the relevant price band exceeds the MW quantity that was available to be provided, then the actual capacity available should be used for the pro-rated dispatch.
- In NER clauses 3.8.19(a), (a2), (b) and (c), fixed loading requirements to be applicable to scheduled bi-directional units.
- In NER clause 3.8.20(k), include scheduled bi-directional units and scheduled loads to ensure AEMO notifies the registered participant if the unit has been operating outside its enablement limit.
- In NER clause 3.8.21(m), include scheduled bi-directional units and scheduled loads to ensure AEMO notifies the registered participant electronically on a confidential basis if the unit has been operating outside its enablement limit.
- In NER clause 3.8.22(m), allow Scheduled Bi-directional Resource Provider to rebid for units in the bi-directional facility, including for scheduled bi-directional units.
- In NER clause 3.8.22A, ensure Scheduled Bi-directional Resource Providers are required to provide dispatch bids and rebids, including for scheduled bi-directional units.
- In NER clause 3.8.22A:
  - Include a scheduled bi-directional unit and where a scheduled bi-directional unit fails to respond to a dispatch instruction and determined by AEMO, it is to be declared and identified as non-conforming and cannot be used to set the spot price.
  - Where a Scheduled Bi-directional Resource Provider fails to meet AEMO's requests under NER clauses 3.8.22A(c)(1) and (2), and AEMO is not satisfied that the scheduled bi-directional unit will respond to dispatch instructions, AEMO may direct the output of the scheduled bi-directional unit.
  - Include an ancillary service bi-directional unit, where the unit is enabled to provide market ancillary services and the unit fails to respond the way identified in the MASS, then:
    - The unit is to be declared and identified as non-conforming.
    - AEMO must advise if the unit has been declared non-conforming, request a reason which the registered participant must provide and the reason logged.
    - AEMO may set a fixed level for the ancillary service bi-directional unit.
  - When AEMO is satisfied the ancillary service bi-directional unit is capable of responding in a way identified by the MASS it must remove the fixed level.
- In NER clauses 3.9.1, 3.9.2 and 3.9.2A, 3.9.3C, 3.9.3D, where relevant, include scheduled bi-directional unit and ancillary service bi-directional unit.

Reliability Standard

- Amend NER clause 3.9.3C:
  - To include bi-directional units in the Reliability Standard.
  - Paragraph (a), to delete 'for generation and inter-regional transmission elements'. Paragraph (b) covers the plant that is covered.
- In NER clause 3.9.3C(a), unserved energy associated with power system reliability incidents to also include a single contingency event on a bi-directional unit or a delay in construction or commissioning of a new bi-directional unit.

Implementation of the Reliability Standard

- The reliability standard implementation guidelines must include the approach AEMO will use and the assumptions it will make in relation to the reliability of existing and future bi-directional units.

Pricing for constrained-on scheduled generating units and scheduled bi-directional units

- Amend NER clause 3.9.7(a) to include that a bi-directional unit can be constrained-on in any dispatch interval and it must comply with the dispatch instruction issued by AEMO in accordance with its availability indicated in its dispatch offer.
- Amend NER clause 3.9.7(b) to include that a Bi-directional Resource Provider that is constrained-on in accordance with clause 3.9.7(a) is not entitled to receive compensations from AEMO if its dispatch price is less than its dispatch offer price.
- Amend NER clause 3.9.7(c) to include that where a bi-directional unit is enabled to provide system strength services under a systems strength services agreement it must comply with the dispatch instruction issued by AEMO in accordance with its availability indicated in its dispatch offer. However, this may not be taken into account in the determination of the dispatch price in that dispatch interval except to the extent that the bi-directional unit is dispatched at a level above its minimum loading level.
- Amend NER clause 3.9.7(d) to include that a Bi-directional Resource Provider that is constrained-on in accordance with clause 3.9.7(c) is not entitled to receive compensations from AEMO if its dispatch price is less than its dispatch bid price.

Market ancillary services

- Amend NER clauses 3.11.2(f) and (h) to include an ancillary service generating unit that has monitoring equipment to monitor and record the unit's response and AEMO may request the Ancillary Service Provider to report details of the unit's response.

NER clause 3.13 – Market information

- Amend NER clause 3.13.1(a), AEMO to provide a Bi-directional Resource Provider, as a Market Participant and on request, with market information that is not defined by the AEMC or the NER as confidential or commercially sensitive.
- Amend NER clause 3.13.3(2A), include that scheduled bi-directional units are to be included in the list of expected closures years and dates.
- Amend NER clause 3.13.3(b1), require Scheduled Bi-directional Resource Providers (as Market Participants) to provide AEMO with the maximum capacity of each scheduled bi-directional unit that is aggregated under NER clause 3.8.3.
- Amend NER clauses 3.13.3(l2)(1) and (3) to reflect that a Bi-directional Resource Provider is the provider of the model source code. Also update NER clause 3.13.3 (l5) and (m) for a bi-directional unit.
- In NER clause 3.13.3(q), require AEMO to prepare and publish the following information in the statement of opportunities:
  - To publish production and consumption capabilities of existing bi-directional units and bi-directional units where formal commitments have been made for construction or installation.
  - The maximum energy capacity of each scheduled bi-directional unit.
  - Planned plant retirements need to include the expected closure years and closure dates for bi-directional units for the subsequent 10-year period.

- In NER clause 3.13.3(r), require AEMO to publish any significant new information that becomes available on the capabilities of existing bi-directional units and bi-directional units where formal commitments have been made for construction or installation after the publication of the statement of opportunities.
- In NER clause 3.13.4(f), the pre-dispatch schedule AEMO must publish needs to include the aggregate available production of bi-directional facilities.
- In NER clause 3.13.4(q), the spot market operations timetable includes the dispatched energy for each scheduled bi-directional unit.

Administered price cap and market suspension

- In NER clause 3.14.5A(a), amend to reflect that the compensation objective is also to maintain Scheduled Bi-directional Resource Providers incentive to supply energy.
- In NER clauses 3.14.5A(d) and (e):
  - Allow a Scheduled Bi-directional Resource Provider to be a Market Suspension Claimant and update existing compensation payment formula, including:
  - Amending formula terms:
    - Delete SOG – sent out generation and replace with SOE – sent out energy.
    - Delete BVG – benchmark value generation and replace with BVE – benchmark value sent out energy.
    - Amend MWE to include the sum of the market ancillary services from an ancillary service bi-directional unit.
    - Amend $BC_{(av)}$ to include a Scheduled Bi-directional Resource Provider.
    - Amend FC, E and VOC to include a Bi-directional Resource Provider.
- In NER clause 3.14.5A(h), AEMO to update market suspension compensation methodology to specify the Scheduled Bi-directional Resource Providers classes and the approach to be adopted in calculating the benchmark values for each class.
- In NER clause 3.14.5A(j), AEMO include Scheduled Bi-directional Resource Providers into the schedule of benchmark values.
- In NER clauses 3.14.5B(a)(3) and (d), include bi-directional unit.
- In NER clause 3.14.6(a), price limit event definition, include Scheduled Bi-directional Resource Providers and ancillary service bi-directional units.
- In NER clause 3.14.6(a):
  - Price limit event definition, include Scheduled Bi-directional Resource Providers and ancillary service bi-directional units.
  - Total costs definition, include Scheduled Bi-directional Resource Providers.
- In NER clause 3.14.6(c) amend to reflect that the objective of compensation payments is also to maintain a Scheduled Bi-directional Resource Providers incentive to supply energy.

Settlements

- In NER clause 3.15.3(a), amend to include that a Market Participant that has classified a bi-directional unit as a market bi-directional unit is financially responsible for that connection point.

Adjusted gross energy amounts – connection points

For the following proposed rules, AEMO has based these on the Global Settlement & Market Reconciliation Rule that comes into effect on 6 February 2022. If the effective date of the proposed rule occurs before this date, AEMO would need to continue to recover non-energy based on the existing NER provisions until the effective date of the Global Settlement & Market Reconciliation Rule.

- In NER clauses 3.15.4(a) and (b), where relevant, update to refer to market connection points instead of connection points.
- In NER clause 3.15.4(a)(1), amend to include:
  - AGE = ASOE + ACE.
  - ACE is the adjusted consumed energy determined under clause 3.15.4(a)(2)
  - ASOE is the adjusted sent out energy amount determined under clause 3.15.4.(a)(3).
- In NER clause 3.15.4(a), create two definitions to be used in non-energy recoveries:
  - Adjusted consumed energy (ACE) for a trading interval – the metered energy (ME) flowing at the market connection point in the trading interval, as recorded in the metering data in respect of that market connection point and that trading interval, where the flow is away from the transmission network connection point to which the market connection point is assigned, expressed as a negative value in MWh and not adjusted for transmission loss factors, so that ACE = ME-.
  - Adjusted sent out energy (ASOE) for a trading interval – the metered energy (ME), flowing at the market connection point in the trading interval, as recorded in the metering data in respect of that market connection point and that trading interval, where the flow is towards the transmission network connection point to which the market connection point is assigned, expressed as a positive value in MWh and not adjusted for transmission loss factors, so that ASOE = ME+.
- Adjusted consumed energy, adjusted sent out energy and adjusted gross energy included as definitions in Chapter 10.
- In NER clause 3.15.4(b)(1), amend to include:
  - AGE = ASOE + ACE.
  - ACE is the adjusted consumed energy determined under clause 3.15.4(b)(2).
  - ASOE is the adjusted sent out energy amount determined under clause 3.15.4.(b)(3).
- ASOE is the adjusted sent out energy amount determined under clause 3.15.4(a)(3). Amend to include NER clauses 3.15.4(b)(2) and (3), where a connection point is not a transmission connection point:
  - Adjusted consumed energy (ACE) amount for that market connection point for a trading interval is calculated by AEMO applying the following formula: ACE = (ME- × DLF) + UFEA

    where:

    ACE is the adjusted consumed energy amount to be determined;

    ME- is the amount of electrical energy, expressed in MWh, flowing at the market connection point in the trading interval, as recorded in the metering data in respect of that market connection point and that trading interval (where the flow is away from the transmission network connection point to which the market connection point is assigned)

    DLF is the distribution loss factor applicable at that connection point; and

    UFEA is the share of unaccounted for energy allocated to that connection point under clause 3.15.5.

- Adjusted sent out energy (ASOE) amount for that market connection point for a trading interval is calculated by AEMO applying the following formula:

  ASOE = ME+ × DLF

  where:

  ASOE is the adjusted sent out energy amount to be determined;

  ME+ is the amount of electrical energy, expressed in MWh, flowing towards the connection point in the trading interval, as recorded in the metering data in respect of that connection point and that trading interval (expressed as a positive value)

  DLF is the distribution loss factor applicable at that connection point.

Unaccounted for energy adjustment – local areas

- Amend ADME to include the aggregate of the amounts represented by ME- × DLF and ME+ × DLF.
- Delete from ADME "and in that aggregation positive and negative adjusted gross energy amounts are netted out to give a positive or negative aggregate amount."

Ancillary service transactions

- In NER clause 3.15.6A(a), include an enabled ancillary service bi-directional unit to determine the trading amount for a Market Bi-directional Resource Provider (Market Participant) and update the formula terms for the ancillary service bi-directional unit:
  - EA – energy amount.
  - ASP – ancillary service price.
- In NER clause 3.15.6A(b1), delete AGE, AAGE, TGE, ATGE, TSGE and ATSGE and include new terms TSOE and ATSOE.
- In NER (c1), in the regional benefit factors definition include:
  - Where a trading amount is determined for a Market Generator by reference to the amount of its adjusted gross energy and the sum of the adjusted gross energy figures for that Market Generator's relevant connection points in a trading interval is negative, the Market Generator's adjusted gross energy for that trading interval is taken to be zero.
- In NER clause 3.15.6A(c2):
  - For NSCAS liability recovery, include Market Bi-directional Resource Providers and Market Small Generation Aggregators in accordance with amendments for paragraphs (c8) and (c9).
  - For SRAS liability recovery:
    - Include Market Bi-directional Resource Providers in accordance with amendments for paragraph (d).
    - Include Market Bi-directional Resource Providers and MSGAs in accordance with amendments for paragraph (e).
- In NER clause 3.15.6A(c3), AEMO to provide Market Bi-directional Resource Providers and MSGAs statements provided under clauses 3.15.14 and 3.15.15 for the amount payable for NSCAS.
- In NER clause 3.15.6A(c4), insert "where applicable" after "AEMO to take into account".
- In NER clauses 3.15.6A(c8) and (c9), include Market Bi-directional Resource Providers and Market Small Generation Aggregators:

  - For a Market Customer, recover based on adjusted gross energy (a netted energy amount) for the relevant region and trading interval.
  - For a Market Bi-directional Resource Provider or Market Small Generation Aggregator, recover based on adjusted consumed energy for the relevant region and trading interval.
  - Amend formula and terms TA_{pr}, and ACE_{pr}, and $AACE_{pr}$, to include Market Customer recovery based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted consumed energy.
  - Delete AGE_{pr} and $AAGE_{pr}$, terms and update formula.
- In NER clause 3.15.6A(d), include Market Bi-directional Resource Providers:
  - For a Market Generator, recover based on adjusted gross energy (a netted energy amount) for the relevant region and trading interval.
  - For a Market Bi-directional Resource Provider or Market Small Generation Aggregator, recover based on adjusted sent out energy for the relevant region and trading interval.
  - Add new term $TSOE_R$ and $ATSOE_R$, to include Market Generator recovery based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted sent out energy.
  - Delete TGE_R, $TSGE_R$, $ATGE_R$, and $ATSGE_R$, terms.
  - Update the formula.
- In NER clause 3.15.6A(e), include Market Bi-directional Resource Providers and Market Small Generation Aggregators:
  - For a Market Customers, recover based on adjusted gross energy (a netted energy amount) for the relevant region and trading interval.
  - For a Market Bi-directional Resource Providers or Market Small Generation Aggregators, recover based on adjusted consumed energy for the relevant region and trading interval.
  - Amend formula terms TCE_R, and $ATCE_R$, to include Market Customer recovery based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted consumed energy.
- In NER clause 3.15.6A(f) for fast raise, slow raise or delayed raise services, AEMO must allocate the global and local market ancillary service requirement and:
  - Recover from Market Generators based on adjusted gross energy.
  - Recover from Market Bi-directional Resource Providers or Market Small Generation Aggregators based on adjusted sent out energy.
  - Add new term TSOE and RATSOE, to include Market Generator recovery based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted sent out energy.
  - Delete TGE, TSGE, RATGE and RATSGE terms.
  - Update the formula.
- In NER clause 3.15.6A(g) for fast lower, slow lower or delayed lower services, AEMO must allocate the global and local market ancillary service requirement and:
  - Recover from Market Customers based on adjusted gross energy (netted energy amount) for the relevant region and trading interval.

  - Recover from Market Bi-directional Resource Providers or Market Small Generation Aggregators based on adjusted consumed energy for the relevant region and trading interval.
  - Amend terms TCE, and RATCE, to include Market Customer recovery based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted consumed energy.
- In NER clause 3.15.6A(i):
  - Amend to include a Market Bi-directional Resource Provider to allow their individual contribution to the aggregate deviation in frequency of the power system to be assessed for regulating raise or regulating lower services.
    - MPF – update to include Market Bi-directional Resource Provider.
- In NER clause 3.15.6A(k)(5), amend paragraph (5) to include a scheduled bi-directional unit and ancillary services bi-directional unit.
- Delete 3.15.6A(o), which includes definitions of generator energy, customer energy and small generator energy and replace with revised definitions of adjusted gross energy, adjusted consumed energy and adjusted sent out energy in Chapter 10.

Payment to Directed Participants, Payment to Directed Participants for services other than energy and market ancillary services

- Amend NER clause 3.15.7, to ensure Scheduled Bi-directional Resource Providers are included in the compensation calculation for directions.
- Amend NER clause 3.15.7A(c)(ii)(A) to include a Bi-directional Resource Provider and Market Bi-directional Resource Provider.

Claim for additional compensation by Directed Participants and Funding of Compensation for directions

- Amend NER clauses 3.15.7B(a)(1) and (a3) to include a scheduled bi-directional unit.
- In NER clause 3.15.8(f)(2) delete TSRP.
- In NER clause 3.15.8(f)(3), delete TSRP,TRSP, TGE, TSGE, ATGE and ATSGE and add TSOE and ATSOE.
- In NER clause 3.15.8(g):
  - Recover from Market Customers and Market Generators based on adjusted gross energy.
  - Recover from Market Bi-directional Resource Providers or Market Small Generation Aggregators based on adjusted consumed energy and adjusted sent out energy.
  - Add new term TSOE and RATSOE to include recover from Market Generator based on adjusted gross energy and Market Bi-directional Resource Provider or Market Small Generation Aggregator based on adjusted sent out energy for all relevant intervention pricing trading intervals.
  - Amend the TCE term to:
    - Adjusted gross energy for Market Customers for all relevant intervention pricing trading intervals.
    - Adjusted consumed energy from Market Bi-directional Resource Providers and Market Small Generation Aggregators for all relevant intervention pricing trading intervals.
  - Amend the TSOE term to:

    - Adjusted gross energy for Market Generators for all relevant intervention pricing trading intervals.
    - Adjusted sent out energy from Market Bi-directional Resource Providers and Market Small Generation Aggregators for all relevant intervention pricing trading intervals.
  - Amend RATSOE term to:
    - Aggregate of the adjusted gross energy for Market Generators for all relevant intervention pricing trading intervals.
    - Aggregate of the adjusted sent out energy from Market Bi-directional Resource Providers and Market Small Generation Aggregators for all relevant intervention pricing trading intervals.
  - Amend RATCE term to the:
    - Aggregate of the adjusted gross energy for Market Customers for all relevant intervention pricing trading intervals.
    - Aggregate of the adjusted consumed energy from Market Bi-directional Resource Providers and Market Small Generation Aggregators for all relevant intervention pricing trading intervals.
  - Delete TGE, TSGE, RATGE and RATSGE terms.
  - Update the formula.
- Delete NER clause 3.15.8(h) which includes definitions of generator energy, customer energy and small generator energy and replace with revised definitions of adjusted gross energy, adjusted consumed energy and adjusted sent out energy in Chapter 10.

Funding of compensation for market suspension pricing schedule periods

- Amend NER clause 3.15.8A(b) to include a Market Bi-directional Resource Provider and Market Small Generation Aggregator in the calculation of the amount payable for market suspension and amend formula terms:
  - MCP to include a Market Bi-directional Resource Provider and Market Small Generation Aggregator.
  - E is also the sum of a Market Bi-directional Resource Provider's and Market Small Generation Aggregator's 'adjusted consumed energy' for the relevant connection points they are financially responsible for.
- Amend NER clause 3.15.8A(c) to ensure that if the figure calculated for a Market Bi-directional Resource Provider or Market Small Generation Aggregator in accordance with clause 3.15.8A(b) is negative, they are liable to pay the absolute value.
- In NER clause 3.15.8A(g)(2) delete TSRP.
- In NER clause 3.15.8A(g)(3), delete TGE, TSGE, ATGE and ATSGE and add TSOE and ATSOE.

Reserve settlements and RERT

For the following proposed rules, AEMO has based these on the Enhancement to the Reliability and Emergency Reserve Trader Rule that comes into effect on 26 March 2020.

- In NER clause 3.15.9(a), also recover the cost of reserves from Market Bi-directional Resource Providers and Market Small Generation Aggregators.
- In NER clause 3.15.9(b)(2)(ii), include a scheduled bi-directional unit.

- In NER clause 3.15.9(d), amend to include recovery of liabilities or distribution of net profits from Market Bi-directional Resource Providers and Market Small Generation Aggregators.
- In NER clause 3.15.9(e), for reserves, update to include that AEMO must calculate an amount payable for Market Bi-directional Resource Providers or Market Small Generation Aggregators and update the formula terms:
  - MCP – update to include Market Bi-directional Resource Providers and Market Small Generation Aggregators.
  - E_{uc} - based on Market Customers' adjusted gross energy and Market Bi-directional Resource Providers' and Market Small GenerationAggregators' adjusted consumed energy.
  - E_{oc} - is the sum of all Market Customers' adjusted gross energy and Market Bi-directional Resource Providers' and Market Small Generation Aggregators' adjusted consumed energy.
- In NER clause 3.15.9(f), ensure a Market Bi-directional Resource Provider and Market Small Generation Aggregator is liable to pay the recovery amount calculated by AEMO under paragraph (e).

Administered price cap or administered floor price compensation payments

- In NER clauses 3.15.10(a) and (b), include a Market Bi-directional Resource Provider and Market Small Generation Aggregator and update the formula:
  - Ei - is the sum of all Market Customers' adjusted gross energy and Market Bi-directional Resource Providers' and Market Small Generation Aggregators' adjusted consumed energy.
  - $\sum E_i$ - include Market Bi-directional Resource Providers and Market Small Generation Aggregators.
- In NER clauses 3.15.10(a), (b) and (c), delete references to 'Ancillary Service Provider', included in the term 'Market Participant'.

Intervention and Market Suspension Pricing Schedule Period Settlements

- In NER clause 3.15.10C(a1)(2), require AEMO to include the amounts payable under NER clauses 3.15.8A(b) and (c) in the final statement for a Market Bi-directional Resource Provider or Market Small Generation Aggregator.

Participant compensation fund and dispute resolution panel to determine compensation

- In NER clause 3.16.1(a), include a Scheduled Bi-directional Resource Provider as a party that can be compensated from the participant fund.
- Amend NER clause 3.16.1(g) and delete 3.16.1(h), to improve the drafting.

Dispute resolution panel to determine compensation

- In NER clause 3.16.2(d), (f) and (h), where relevant, include Scheduled Bi-directional Resource Provider and scheduled bi-directional unit.

Settlements residue committee

- In NER clause 3.18.2(b), include a Market Bi-directional Resource Provider as an eligible person.
- In NER clause 3.18.5(c)(2), among other representatives, include that a Bi-directional Resource Provider or Generator can be a representative on the settlements residue committee.

Reliability and Emergency Reserve Trader

For the following proposed clause, AEMO has based this on the Enhancement to the Reliability and Emergency Reserve Trader Rule that comes into effect on 26 March 2020.

- Where relevant, in NER clauses 3.20.3(a)(1) and (g), 3.20.4(a), 3.20.6(a), (b)(2), (c)(2) and 3.20.7(b), (c), and (d) include bi-directional units, scheduled bi-directional units, Scheduled Bi-directional Resource Provider.

Schedule 3.1

Schedule 3.1 requires the following minimum information for a scheduled bi-directional unit:

- Facility information.
- Facility name.
- Scheduled bi-directional unit information.
- Scheduled bi-directional unit name.
- DUID.
- Maximum produced electricity (in MW) of the scheduled bi-directional unit, to which the scheduled bi-directional unit may be dispatched.
- Maximum consumed electricity (in MW) of the scheduled bi-directional unit, to which the scheduled bi-directional unit may be dispatched.
- Maximum ramp rate (measured in MW/minute) of the scheduled bi-directional unit.

The ancillary services table in Schedule 3.1 is amended to include ancillary service bi-directional units, which requires an ancillary services bi-directional unit to provide the same data as an ancillary services generating unit and ancillary service load.

4.3.3 Chapter 4, 4A and 5

In NER Chapters 4 and 5, the proposed rule would require appropriate drafting to:

- Integrate the Bi-directional Resource Provider, bi-directional facility and bi-directional unit and ensure the relevant technical requirements for bi-directional facilities and bi-directional units are applicable.
- Ensure performance standards are based on the assets being connected to the national grid, instead on a registered participant category.

In NER Chapter 4A, the proposed rule would:

- Amend NER clause 4A.D.2(a) to include an additional sub-clause to provide that a Bi-directional Resource Provider is a liable entity if it has a bi-directional facility in the region that includes a load.
- Include an additional clause 4A.D.2(c) to provide that a registered participant who purchases electricity at a connection point in the region is not a liable entity unless specified in paragraph (a).
- Ensure the liability of a Bi-directional Resource Provider for the load within its bi-directional facility is determined by the consumption drawn from the national grid to supply that load (only).

4.3.4 Chapter 6 and 6A

In NER Chapter 6, the proposed rule would require appropriate drafting to:

- Amend NER clause 6.1.4 to ensure DUOS charges are not charged for sent out electricity from a bi-directional unit connected to a distribution network.

- Amend relevant terms and definitions to incorporate bi-directional facilities.

In NER Chapter 6A and relevant Chapter 10 definitions, the proposed rule would require appropriate drafting to ensure TUOS is not charged for stand-alone bi-directional units or the energy attributable to the bi-directional unit within a bi-directional facility.

4.3.5 Chapter 7

In NER Chapter 7, the proposed rule would require appropriate drafting to:

- In NER clause 7.4.1(e), restrict a Market Bi-directional Resource Provider (and MSGA, as identified in section 3.5.5) from being a Metering Provider at connection points where they are responsible for the energy.
- In NER clause 7.4.2(e), restrict a Market Bi-directional Resource Provider from being a Metering Data Provider at connection points where they are responsible for the energy.
- In NER clause 7.6.2(a)(2), include that a Metering Coordinator may only be appointed for a connection point with a bi-directional facility by the person who owns, controls or operates the bi-directional facility or bi-directional unit connecting to a distribution network.
- In NER clause 7.8.2(g), amend to include a small bi-directional unit, which must have a type 1-4 metering installation that is capable of recording interval energy data.

4.3.6 Chapter 8

In NER Chapter 8, the proposed rule would require appropriate drafting to:

- In NER clause 8.2.1(h), exclude a decision not to classify an asset in a bi-directional facility as scheduled or semi-scheduled under rule 2.2A.
- If considered appropriate at this time, in NER clause 8.8.2, adjust the Reliability Panel representation provisions to include a requirement for representation of Bi-directional Resource Providers.

4.3.7 Other integration changes

Section 3.5.5 identified other integration issues, the table below includes the proposed rule to address these.

Table 5 Proposed rule - other integration changes in the NER

Clause	Proposed change
2.2.1(c), (d)	Delete note in paragraph (c). In paragraph (d) add a new sub-paragraph to clarify that AEMO can also provide an exemption to a person or class of persons from the requirement to register as a Generator for generating units.
2.2.7(i)- (l)	Delete. Clause 3.8.3 amendments to include semi-scheduled generating unit aggregation.
2.2.6(b), (e)(2), 2.3.5(b)(1), (e)(1A), (2)	Amend references to the registered participant category and replace with 'applicant'.
2.2.6(d), 2.3.5(d), 2.9A.2 (d)	Amend to allow AEMO the discretion to withdraw an application for registration.
3.6.3(c) and (d)(1)	Delete reference to 'load'.
3.6.5(4), (4A)	Delete.

Clause	Proposed change
3.7C, 3.8.10, 3.9.3D	Add new paragraph to allow AEMO to make minor and administrative changes to the Constraint Formulation Guidelines, EAAP Guidelines and reliability standard implementation guidelines without complying with the Rules consultation procedures.
3.8.4(c)(3)	Add '*scheduled*'.
3.8.5(b)	Remove (b)(1) – (3) and ensure that MW quantities in the dispatch bid can be submitted after the relevant deadline in the timetable.
3.8.6(c), (h)(3)(ii),(f), (h)(1), (2), 3.12.2(2)	Delete either 'multiplied by' or 'product of'.
3.8.7(m)	Delete 'may' and replace with 'must'.
3.8.17(c), 3.8.18(a)	Add '*scheduled*'.
3.8.18(e)	Delete 'or *Market Participant*'.
3.8.20(g)	Semi-scheduled and scheduled generating unit included and clause simplified by referring to '*scheduled plant*' and '*market ancillary service*'.
3.8.20(i)	Delete '*Scheduled Generators*' and '*Semi-Scheduled Generators*'.
3.8.20(j)(2)	Delete 'entity' and replace with 'unit'.
3.8.20(k)	Include '*scheduled load*'.
3.8.21(d)	Delete "where possible" and "via the *automatic generation control system* or *electronic communication system* via an electronic display in the *plant* control room (which may be onsite or offsite)". Replace with "dispatch instructions will be issued electronically to the relevant *Registered Participant*."
3.13.3(a)(3)	Delete references to '*Scheduled Generators*' and '*Semi-Scheduled Generators*'.
3.13.3(l2)	Delete and refer to 3.13.3(a) amendment.
3.13.3(l2)(5)	Italicise '*Transmission Network Service Provider*'.
3.13.4(p)(5)	Remove reference to "as measured by *AEMO's* telemetry system".
3.15.8(f)(2), 3.15.8A(g)(2), 3.15.10C(b)(7)(i), (c)(3)(iii)(B)	Delete references to 'TSRP', this is not defined.
3.15.8(f)(2)	Delete references to 'TRSP', this is not defined.
3.15.21(c2)(2)(ii)	Amend to include '*Market Ancillary Service Provider*' and '*Market Bi-directional Resource Provider*'.
7.4.1(e)	Include '*Market Small Generation Aggregator*'.

Additionally, in draft NER Chapters 2, 3 and 10, AEMO's proposed rule seeks to include terms to integrate the Bi-directional Resource Provider and bi-directional units into the NER. Further drafting changes are to simplify and streamline NER. Key changes proposed:

- Where possible, delete references to "generation", "generate" and "generating" and replace with technology neutral terms, e.g. "produced electricity" or "sent out electricity", "production" and "produced". The definitions themselves are only changed to include a bi-directional unit.

- The definition of "load" is amended to remove the electricity flow component, which is replaced by a new term and references to "consumed electricity" and "consumption". References to "load" where it refers to the electricity flow are replaced with "consumed electricity" and "consumption".
- Where relevant, defined terms are used like "Scheduled plant", "Registered Participant", "Market Participant".

4.3.8 Proposed definitions

All proposed new, amended and deleted definitions relating to proposed changes for NER Chapter 2 and 3 are in Table 6, and provided in the marked-up version of Chapter 10 submitted with this proposal.

Table 6 Proposed new, amended, and deleted Glossary definitions

Term	New/ amend/ delete	Proposed definition or change
adjusted consumed energy	New	Has the meaning given to it in clause 3.15.5 (for a transmission network connection point) or clause 3.15.5A (for a virtual transmission node) or clause 3.15.4 (for any other connection point). In relation to a Market Participant in a given category, the sum of the adjusted consumed energy for the connection points for which that Market Participant is financially responsible in that capacity.
adjusted gross energy (in Glossary and previously in Chapter 3)	Amend	Has the meaning given to it in clause 3.15.5 (for a transmission network connection point) or clause 3.15.5A (for a virtual transmission node) or clause 3.15.4 (for any other connection point). In relation to a Market Participant in a given category, the sum of the adjusted gross energy for the connection points for which that Market Participant is financially responsible in that capacity.
adjusted sent out energy	New	Has the meaning given to it in clause 3.15.5 (for a transmission network connection point) or clause 3.15.5A (for a virtual transmission node) or clause 3.15.4 (for any other connection point). In relation to a Market Participant in a given capacity, the sum of the adjusted sent out energy for the connection points for which that Market Participant is financially responsible in that capacity.
AEMO intervention event	Amend	Amend to include 'scheduled bi-directional units'.
Affected Participant	Amend	Amend to include 'Scheduled Bi-directional Resource Provider' in relation to the exercise of RERT.
Ancillary Service Provider	Amend	Amend to include 'scheduled bi-directional unit' and 'ancillary service bi-directional unit'.
automatic generation control system (AGC)	Amend	Amend to include 'scheduled bi-directional units'.
available capacity	Amend	Amend to include 'scheduled bi-directional unit'.
bid validation data (replaces 'bid and offer validation data')	Amend	Amend to include 'Scheduled Bi-directional Resource Providers' (which 'Market Participant' covers) and 'scheduled bi-directional units'.
bi-directional facility	New	(a) A facility incorporating one or more bi-directional units. (b) A facility incorporating an interconnected combination of one or more: (i) bi-directional units with generating units and/or loads; or (ii) generating units with loads, where that combination of interconnected plant:

Term	New/ amend/ delete	Proposed definition or change
		(iii) is connected to a transmission or distribution system at a common connection point; and (iv) can be operated such that, at any time, there may be an amount of sent out electricity or an amount of consumed electricity at the connection point.
Bi-directional Resource Provider	New	A person who engages in the activity of owning, controlling or operating a bi-directional facility that is connected to a transmission or distribution system and who is registered by AEMO as a Bi-directional Resource Provider under Chapter 2.
Bi-directional Resource Provider transmission use of system, Bi-directional Resource Provider transmission use of system service	New	A service provided to a Bi-directional Resource Provider for use of a transmission investment for the conveyance of electricity that can be reasonably allocated to a Bi-directional Resource Provider on a locational basis.
bi-directional unit	New	Plant that has the capability to both: (a) consume electricity to convert into stored energy; and (b) convert stored energy to produce electricity, together with all related equipment essential to its functioning as a single entity.
central dispatch	Amend	Amend to include 'scheduled bi-directional units'.
constrained off	Amend	Amend to include 'scheduled bi-directional unit' and replace 'dispatch offer' with 'dispatch bid'.
constrained on	Amend	Amend to include 'scheduled bi-directional unit' and replace 'dispatch offer' with 'dispatch bid'.
constraint, constrained	Amend	Amend to include 'scheduled bi-directional unit' and replace ‘generate’ with ‘produce’.
consumed electricity	New	The amount of electrical power delivered from a network at a defined instant or over a defined period at a connection point, or aggregated over a defined set of connection points.
Customer	Amend	Amend to include that a Bi-directional Resource Provider is a Customer where the electricity is supplied to a load forming part of a bi-directional facility.
default dispatch offer	Deleted	All references to ‘default dispatch offer’ to be replaced with ‘default dispatch bid’.
Directed Participant	Amend	Amend to include 'Scheduled Bi-directional Resource Provider'.
Dispatch	Amend	Amend to include 'scheduled bi-directional unit', 'ancillary service bi-directional unit', and remove references to of ‘dispatch offer’ and replace ‘market ancillary service'offer' with ‘market ancillary service bid’.
dispatch bid	Amend	Replace 'Market Participant' with 'Registered Participant', delete ‘scheduled load’ and replace with 'scheduled plant’ and amend to include in accordance with clause 3.8.6, 3.8.6A.
dispatch offer	Delete	All references to ‘dispatch offer’ to be replaced with ‘dispatch bid’.

Term	New/ amend/ delete	Proposed definition or change
dispatch bid price (replaces 'dispatch offer price')	Delete and replace	The price submitted by a registered participant for a price band and a trading interval in a dispatch bid.
dispatchable unit identifier	Amend	Amend to include 'scheduled bi-directional unit'.
dispatched bi-directional unit	New	A scheduled bi-directional unit which has received instructions from AEMO in accordance with a dispatch schedule.
dispatched electricity	New	The consumed electricity and produced electricity which has been dispatched as part of central dispatch.
dispatched load	Delete	Delete definition as covered by definition of scheduled load.
dispatched load	Amend	Replace 'load' with ''consumed electricity'.
dispatched produced electricity (replaces 'dispatched generation')	Delete and replace	The produced electricity which has been dispatched as part of central dispatch.
embedded bi-directional unit	New	A bi-directional unit connected within a distribution network and not having direct access to the transmission network.
enabled, enable	Amend	Amend to include 'bi-directional unit'.
enablement limit	Amend	Replace 'market ancillary service offer' with ' market ancillary service bid' and delete reference to 'generation or load' and replace with 'consumed electricity and produced electricity'.
energy constraint	Amend	Amend to include 'bi-directional units or a group of bi-directional units', rewording included appropriate for bi-directional units and generating units and include 'stored energy' as a potential energy limit.
facilities	Amend	Amend to replace 'generating unit' with 'generating system' and include 'bi-directional facility'.
Financially responsible	Amend	Amend to include 'bi-directional unit'/ 'market bi-directional unit'.
GELF parameters	Amend	Amend to include 'Scheduled Bi-directional Resource Provider'.
generation dispatch offer (replaced with 'dispatch bid')	Delete	Deleted and all references to be replaced with 'dispatch bid'.
Generator	Amend	Amend to include that a Bi-directional Resource Provider is a Generator in respect of a generating system that forms a part of a bi-directional facility.
Generator Energy Limitation Framework (GELF)	Amend	Amend to include 'bi-directional unit' and replace 'generate' with 'produce'.
inertia unit (replaces 'inertia generating unit')	Amend	Amend to replace 'inertia generating unit' with 'inertia unit' and include 'bi-directional unit'.
inflexible, inflexibility	Amend	Amend to include 'scheduled bi-directional unit'.
load (new definition of 'consumed electricity' to refer to the electricity flow	Amend	Remove 'or the amount of electrical power delivered at a defined instant at a connection point, or aggregated over a defined set of connection points.' This part of the existing load definition is now in the proposed definition of consumed electricity.

Term	New/ amend/ delete	Proposed definition or change
		The proposed definition makes it clear that load refers to the connection point(s) or plant located at a connection point: Proposed definition: (a) A connection point or defined set of connection points at which electrical power is delivered to a person or to another network; or the amount of electrical power delivered at a defined instant at a connection point, or aggregated over a defined set of connection points (b) The plant at a connection point or defined set of connection points involved in utilising electricity, but is not part of, or auxiliary to, a generating system or a bi-directional unit.
loading price	Amend	Replace 'offer' with 'bid'.
Market Ancillary Service Provider	Amend	Replace 'offers' with 'bids'.
Market Bi-directional Resource Provider	New	A Bi-directional Resource Provider who has classified a bi-directional facility as a market bi-directional facility.
market connection point	Amend	Amend to include 'market bi-directional unit'.
market generating unit	Amend	Amend to replace 'sent out generation' with 'sent out electricity'.
Market Generator	Amend	Amend to include a 'Bi-directional Resource Provider' and 'Market Bi-directional Resource Provider'.
Market Participant	Amend	Amend to include 'Market Bi-directional Resource Provider'.
Market Small Generation Aggregator	Amend	Amend to include an MSGA is also a person who has classified one or more small bi-directional units as a market bi-directional unit.
Market Suspension Compensation Claimant	Amend	Amend to include 'Scheduled Bi-directional Resource Provider', 'ancillary service bi-directional unit' and 'scheduled bi-directional unit'.
market suspension pricing schedule period	Amend	Amend to include 'ancillary service bi-directional unit'.
metering, metered	Amend	Edited, removal of capitalisation in definition and past tense added.
network dispatch bid (replaces 'network dispatch offer')	Replace	Replace references to 'network dispatch offer' are to be replaced with 'network dispatch bid'.
non-market generating unit	Amend	Amend to replace 'sent out generation' with 'sent out electricity'.
Off-loading price	Amend	Replace 'offer' with 'bid'.
off-loading price band	Amend	Replace 'offer' with 'bid'.
PASA availability	Amend	Amend to include 'scheduled bi-directional unit'.
peak load	Delete	Delete definition. Peak load is defined as maximum load, peak and maximum are interchangeable.
Plant	Amend	Amend (a) to: include 'producing' and 'supplying'; (b) to delete 'and offers' and replace 'controllable generating equipment and controllable loads' with 'scheduled plant'; and (c) amend to include ' and bi-directional facilities'.

Term	New/ amend/ delete	Proposed definition or change
power station	Amend	Amend to include that a power station also means a facility in which any of that Bi-directional Resource Provider's bi-directional units, generating units or loads are located.
price band	Amend	Delete 'dispatch offer'.
produced electricity	New	The amount of electrical power (measured in MW) produced by a generating unit or bi-directional unit and measured at its terminals.
Scheduled Bi-directional Resource Provider	New	A Bi-directional Resource Provider who has classified one or more bi-directional units, generating units or loads in a bi-directional facility as a scheduled bi-directional unit, scheduled generating unit or scheduled load.
scheduled bi-directional unit	New	(a) A bi-directional unit so classified in accordance with Chapter 2. (b) For the purposes of Chapter 3 (except clause 3.8.3A(b)(1)(iv)) and rule 4.9, two or more bi-directional units referred to in paragraph (a) that have been aggregated in accordance with clause 3.8.3.
Scheduled Generator	Amend	Amend to include 'Bi-directional Resource Provider'.
Scheduled load	Amend	Amend to include a load forming part of a market bi-directional facility which has been classified as a scheduled load by the Market Bi-directional Resource Provider in accordance with Chapter 2.
scheduled plant	Amend	Amend to include a 'scheduled bi-directional unit'.
scheduled reserve	Amend	Amend to include 'scheduled bi-directional units'.
Self-dispatch level	Amend	Replace 'dispatch offer' with 'dispatch bid'.
Semi-Scheduled Generator	Amend	Amend to include 'Bi-directional Resource Provider'.
Sent out electricity (replaces 'sent out generation')	New	In relation to a generating unit or bi-directional unit, the amount of electricity supplied to the transmission or distribution network at its connection point.
sent out generation	Delete	Delete. All references to be replaced with 'sent out electricity'.
small bi-directional unit	New	A bi-directional unit which is owned, controlled or operated by a person that AEMO has exempted from the requirement to register as a Bi-directional Resource Provider in respect of that bi-directional unit in accordance with clause 2.2A.1(b).
system strength unit (replaces 'system strength generating unit')	Delete and replace	A generating unit or bi-directional unit registered with AEMO under clause 5.20C.4(b).
Tie	Amend	Delete reference to 'dispatch offers'.
unscheduled reserve	Amend	Amend to include 'bi-directional units' and to exclude 'scheduled bi-directional units'.

4.3.9 Chapter 11 - Transitionals required

Transitional and saving provisions likely to be required by the rule will need to cover, as a minimum:

- Amendments to relevant procedures, standards and guidelines.

- Application to existing participants who will subsequently meet the criteria for registration as a Bi-directional Resource Provider.
- Basis for charging participant fees to maintain the existing basis for charging ESS participants (as Market Generators and Market Customers) until AEMO's Participant fee determination is updated to include the new category.

More detailed information is provided below on the first two of these items.

The period required between the making of the final rule and its effective date will need to be determined once the extent of the rule is more settled and system changes can be specified and co-ordinated with other relevant regulatory change projects. AEMO notes that the need for additional transitional provisions may be identified as the project progresses, to allow for the management of any residual system implementation issues.

Procedure, standard and guideline changes

Transitional provisions relating to the steps required to prepare for implementation will need to cover amendment, with consultation as required (include pre-final rule consultation as appropriate), on several AEMO procedures and guidelines. AEMO has identified the following at this stage:

- NER clause 3.3.8, the Credit Limit Procedures.
- NER clause 3.4.3, the Spot Market Operations Timetable.
- NER clause 3.6.2(d1), the Forward Looking Loss Factor Methodology.
- NER clause 3.7C(o), the EAAP Guidelines.
- NER clause 3.7D(f), the Demand-side Participation Information Guidelines.
- NER clause 3.9.3(e), the Intervention Pricing Methodology.
- NER clause 3.11.2(b), the MASS.
- NER clause 3.14.5A(h), the Market Suspension Compensation Methodology.
- NER clause 3.8.1(c), the Constraint Formulation Guidelines.
- NER clause 3.7A(m), the Congestion Information Resource Guideline.
- NER clause 7.6.2, Market Settlement and Transfer Solution Procedures.

Transitional requirements would also need to be considered for the Reliability Panel to update the Reliability standard and settings guidelines in accordance with NER clause 3.9.3A.

Application to existing registered participants

While particular cases may require further consideration, as a general principle AEMO expects it would be appropriate to grandfather the registration, classification and dispatch arrangements in place for registered participants prior to the rule effective date. However, those registered participants should also have the option of applying to AEMO to transition to the Bi-directional Resource Provider category. This can occur either during a window before, or at any time after, the rules effective date.

5. HOW THE PROPOSED RULE CONTRIBUTES TO THE NATIONAL ELECTRICITY OBJECTIVE (NEO)

As discussed, the NEM is changing and there is a need to ensure the regulatory framework adapts to facilitate the use of new technologies that support the electricity system and allows the challenges they bring to be managed. The proposed rule clarifies the NEM's regulatory framework for ESS by identifying how it would participate as a stand-alone ESS or in a 'hybrid' facility, this seeks to create a level playing field for ESS to compete equally with other assets.

AEMO considers the proposed rule will be in the long-term interests of electricity consumers with respect to promoting efficient investment in and efficient operation and use of electricity services.

The proposed rule will contribute to the NEO by improving efficient operation and investment of electricity services by:

- The NER recognising ESS as an asset that is distinct from a generating system or a load because it has the ability to consume, store and produce electricity. Defining and recognising ESS allows clarification of relevant NER requirements associated with ESS, this increases clarity and transparency for all stakeholders.
- The new registered participant category assists in removing barriers for ESS and 'hybrid' facility proponents by providing a clearer participation model and reducing the complexity. In addition, this provides arrangements that support the transition to an electricity system where more ESS is needed to support the integration of VRE, which could reduce the cost of operating the system and help avoid or defer the need for network investment.
- A single dispatch model and bidding for an ESS will:
  - Reduce the set-up and ongoing operational costs of participating in central dispatch. Stakeholders would be required to set-up and operate a less complicated bidding and dispatch system instead of managing two dispatch bids, two dispatch instructions and incurring costs (including lost opportunities) associated with managing any conflicts. This would also ensure that ESS is treated as any other asset participating in the NEM.
  - Make it easier for the market to understand and analyse data for the ESS.
- Clarifying TUOS and DUOS charging arrangements for an ESS, improves:
  - Investor certainty because the policy would be certain and an ESS proponent could assess with certainty whether these costs need to be accounted for when assessing their potential business investments. This also eliminates any perverse incentives for locating ESS in some regions where charges may be unclear or to configure facilities for the purpose of defeating any charging requirements rather than in a way that reflects efficient outcomes.
  - Operational efficiency as certainty reduces the inefficiency and debate associated with contesting whether an ESS should be charged TUOS or DUOS.
- Recovering non-energy costs from Bi-directional Resource Provider's and MSGA's based on their consumed or produced energy ensures they pay their share of costs for the non-energy services they contributed towards the need for. This improves allocative efficiency because a Bi-directional Resource Provider and an MSGA would produce or consume electricity at a price that better reflects the costs associated with their production.

AEMO has also included consequential drafting changes to facilitate the integration of ESS and Bi-directional Resource Providers, and transition the NEM framework to an environment where bi-directional flows are better reflected. Incidental changes are also proposed to clarify, increase the

consistency of existing NER terms and streamline rules to improve the understandability, eliminate redundant drafting, and correct for errors. This reduces NER complexity and eliminates interpretive risks, which reduces the confusion and time spent clarifying and debating the NER.

6. EXPECTED BENEFITS AND COSTS OF THE PROPOSED RULE

The expected benefit of the proposed rule is to:

- Update the NER to better reflect the assets and facilities that are expected to be seen in the future. And create a framework that is consistent with a system transitioning to bi-directional energy flows at each point of connection.
- Improve regulatory certainty, operational efficiency and reduce the associated costs by:
  - Clarifying how an ESS and 'hybrid' facilities are to register and participate in the NEM.
  - Clarifying the regulatory arrangements and obligations relevant to an ESS and 'hybrid' facilities. This would facilitate streamlining the NEM registration, dispatch and operational processes for ESS and 'hybrid' arrangements (combinations of ESS, generating systems and load).
- Simplify and facilitate more efficient operation of ESS in the NEM by:
  - A single dispatch bid optimising the consumption and production of energy and FCAS services. This will allow participants to better manage dispatch of their ESS.
  - Representing ESS market data as a single DUID per unit (currently two) which will increase transparency of these assets, thereby simplifying understanding and analysis by industry.
  - Simplifying IT arrangements for proponents and AEMO. This will reduce set up and ongoing operational costs.
  - Clarifying and ensuring appropriate recovery of fees and charges and non-energy cost recovery methodologies.
- Eliminate any interpretive risks associated with the current NEM arrangements. A lack of certainty can cause confusion and lead to time consuming clarifications and debate.
- Facilitate better estimation of ESS energy limits, thereby improving the information accuracy of forecasting tools for market participants and intervention mechanisms.

The proposed rule requires that Bi-directional Resource Providers and MSGAs pay for non-energy cost recoveries based on their consumed and sent out energy. While this change is considered appropriate, this will cost MSGAs more if they are consuming or producing in affected intervals[33]. This change also creates a difference in non-energy cost recovery arrangements between registered participant categories, e.g. Market Customers who may also have 'exempt' ESS as a part of their portfolio and Market Generators who are not recovered from for their consumed electricity (referred to as auxiliary supply). As discussed, the AEMC should consider whether these arrangements should be consistent across all registered participant categories to ensure incentives to consume or produce electricity are the same.

The estimated AEMO implementation costs associated with the proposed rule are around $8 million, this includes:

- System, application, procedure and guideline changes necessary to:
  - Implement the Bi-directional Resource Provider category.
  - Create a single dispatch model.

[33] ESS proponents would not be affected because they are currently registered as a Market Customer and Market Generator, each with a separate NMI (one is a dummy NMI). Under this approach, an ESS proponent would currently have non-energy cost recoveries calculated based on their consumed and sent out electricity.

  - Settle and recover non-energy services and Participant fees from Bi-directional Resource Providers and MSGAs.

- Application, procedure and guideline changes needed to undertake and incorporate the proposed rule.

Potentially, the proposed rule may also result in amendments to other legislative instruments and NER-related documents. Some of these may already require amendment for changes seen in the market today, e.g. licencing requirements for 'hybrid' facilities.

While the proposed rule does not require existing ESS operators to transfer to the proposed Bi-directional Resource Provider registered participant category, where these operators register for new ESS they are likely to incur costs in developing new software, systems and processes to manage a single ESS dispatch bid. These one-off costs need to be balanced against the reduction in costs for future ESS operators.

Appendix A. Summary of submissions to the Emerging Generation and Energy Storage Stakeholder Paper

ID	Question	AGL	ARENA	Australian Energy Council	CEC	Edify	ENEL	Energy Australia	Energy Queensland	GE	Hydrostor	Hydro Tasmania
1	Referring to Section 2.3, are there any other issues with the current arrangements for Energy Storage Systems (ESS)?					1. The requirement that connection points are located closely to physical point of common coupling with the connecting NSP as possible. Recommends allowing connection point to be established on or moved to Medium Voltage side of substations with clear guidelines. 2. Network creation clarity. Recommend a clear process to create networks. 3: Recommend creating a quasi-scheduled classification recognising the real-time firming attributes of ESS rather than scheduled. 4. Hybrid single generating systems being assigned dynamic classifications. 5. ESS being used to manage systemic curtailment.				1. The definition should clearly indicate that the resource is capable of storing and releasing energy, but that it need not be stored/released from the grid; rather, it can be to or from a multitude of energy sources (local or not). 2. An ESS as part of a hybrid may wish to operate in smoothing mode, however at times may also want to provide other grid services. It should be allowed to operate beyond its smoothing-mode capacity without risk of being non-conforming. 3. To qualify the ESS as an Energy generating asset, NEM should define the storage duration of an ESS (Power & Energy) to be credited as a generation asset. 4. In the case of DC coupled systems, the resource may share inverters with other generation sources. In this case the hybrid asset cannot import and export simultaneously.	1. The uncertainty associated with fees, recovery, TUOS, and non-energy recovery are more pronounced at the distribution level. 2. ESS devices should be exempt from DUOS for charging. 3. Suggest the addition of the issue related to the insufficient price signals and mechanisms in the NER to support investment required to achieve the level of ESS capacity identified in the ISP. In an energy only NEM, limited depth associated with remuneration of other functions of ESS, could create an issue in securing the long-term investment required to achieve the level of ESS capacity identified in the ISP. 4. Consideration should be given to introducing a mechanism in the NER that enables an ESS to derive a dual revenue stream on a prescribed and contestable basis.	
2	Do you have any views on whether a definition of ESS should be included in the National Electricity Rules (NER)?	Definition of ESS should be included in the NER		Definition of ESS should be included in the NER		Definition of ESS should be included in the NER		Key benefit: Streamlining registration rather than registering as Market Customer & Generator.	If it is defined in the NER, it should support creating a market participant category for ESS that allow it to compete with other participant categories. This definition should be driven by customer needs/requirements.	Including the definition in the NER reduces complexity and reflects changing technologies being connected to the grid.	Definition of ESS should be included in the NER	
3	Do you have any views on whether a definition of ESS should be generic and encompass	Definition should be generic and technology neutral to support all forms of energy storage as	Definition should be technology neutral.	The definition of ESS must be generic in order to encompass technologies broader than simply batteries	Definition should be generic and consistent with international definitions, taking	Definition should be technology neutral but rules should still take into account			Should be technology neutral but also specific enough to avoid overlap into other	Should be generic and future-proof against changes/developments to the NER.	Definition should be technology neutral and generic.	Definition should be technology neutral and generic.

ID	Question	AGL	ARENA	Australian Energy Council	CEC	Edify	ENEL	Energy Australia	Energy Queensland	GE	Hydrostor	Hydro Tasmania
	technologies other than batteries, for example, pumped hydro?	well as be consistent with international definitions. This would help futureproof the NER and NEM operational processes for new ESS technologies.		and even pumped hydro. For example, storage options could also include compressed air and thermal energy.	into account existing NER definitions	limitations of different technology			categories such as electric vehicles.	Capabilities and characteristics of ESS should also be defined generically to avoid restricting the field of technology		
4	Do you have any views on AEMO's suggested definition of ESS?	Support AEMO's proposed definition. Should ensure the definition is compatible with other NER and NERL references. AEMO could amend the proposed definition by adding in a reference to 'ancillary and auxiliary support' to include other value services that may be provided. Any NER definition of ESS should also be compatible across the transmission and distribution systems in line with the reference to 'national grid'. AEMO should consider if the ESS definition works for DER resources and installations on an exempt/embedded network.		Support AEMO's proposed definition.	Agreed that batteries/pumped storage are bi-directional devices that can assist in wholesale market bidding. AEMO needs to clarify whether this will be in a nameplate or additional ratings basis.		Support AEMO's proposed definition		The term "later" needs defined boundaries, EG: Capacitor Banks. Suggests making distinction between "in front of meter" and "behind the meter" sources of load and generation.	AEMO's definition is appropriately broad. However the clause "storing it for later export to the national grid or Customer . . .at the same site" is ambiguous and would disqualify mobile energy storage devices as discharge must have occurred at the same site as charging. Suggested definition: A resource capable of receiving imported energy from the national grid or other energy source and storing it for later export of energy to the national grid, or Customer located (or connected) at the same site	The definition should be simplified by removing the reference to Customer and site. The intricacies of Customer and site could be addressed in specific clauses in the NER. This would align the NER definitionmore closely with that of UK- OFGEM and USA- FERC, making it more universal and avoid complicating the definition by trying to define its physical location of connection. Suggest the definition be broadened to include any resources that store imported energy for later delivery to any grid or user of electricity.	
5	What are your views on the appropriate participation model for integrating ESS into the NEM?	Support AEMO's recommendation to explore the creation of a Bi-directional Resource Provider participant category. This option appears to provide the most flexibility to participants seeking to install a stand alone ESS/hybrid generation system with an ESS.	A technology neutral, performance-based approach to registration may result in single category of participant in the longer term. This participant would self-forecast, bid & scheduled variably.	Both Option 1 (a new registered participant category) and as a further progression, Option 2a (a new Bi-directional Resource Provider registered participant category) offer promise for further development of a suitable category. The solution needs to be simple for market participants to administer and allow the efficient management of resources.		Agree with robust approaches addressing stand-alone & hybrid ESS. Option 2a appears to do this. Notes a blanket scheduled approach may constrain the potential for ESS to improve system security. The "retrofit scenario" needs to be acknowledged regardless of option chosen, especially as ESS costs decline.	Encourage AEMO to further test the incentives created by both options (2a and 2b) and to accommodate plants deployed under the interim arrangements.	Support AEMO progressing analysis of Option 1. Consider how bids are optimised with FCAS, how pre-dispatch operates - how pre-dispatch reflects availability constraint. Further clarity needed on how bids/offers would be made to reflect a desire to switch from bids reflecting charging at -$1000/mw to discharging.	Support maximium flexibility to allow for variety of business models. Cautions that NER could be impacted by a broad definition and unintended consequences.	Option 1 is undesirable - may hinder innovation, produce computational problems and yield a suboptimal outcome. Option 2b is undesirable as it restricts a generating unit/system and a load from being aggregated together or with a BESS when certain hybrid configurations may produce an optimal outcome with an aggregation of this kind. Option 1 ,2a and 2b, each could be covering a different scenario and having all 3 options simultaneously for	Support option 2a	

ID	Question	AGL	ARENA	Australian Energy Council	CEC	Edify	ENEL	Energy Australia	Energy Queensland	GE	Hydrostor	Hydro Tasmania
										participants is an alternative. Option 2a seems to be the broader, most flexible and least restrictive, enables standalone to complex hybrid systems, thus recommended as preferable choice in the proposed choices.		
6	Would the proposed participation model (see stakeholder paper, section 2.4.2, option 2b) meet your future needs, both in terms of participating in the NEM with an individual ESS or where multiple resources (e.g. ESS and generating units) are to be aggregated?	Further details on the aggregation model (Option 2a) required to make this assessment. There are a range of benefits that should be further explored	Agree that option 2a presents a technology neutral performance-based approach. This will provide the most efficient and durable solution.		This model should not result in a mandated approach where all ESS systems must register as a hybrid. To do so could greatly complicate participants' ability to bid co-located assets. Participants should be allowed some degree of discretion as to how it registers an ESS.	The benefits of ESS to provide firming services to VRE should be permitted in both a physically co-located and a 'virtual' (physically separate but within the same RRN) scenario and could be applied by allowing joint submission of offers into energy markets. Benefits also include using ESS to capture curtailed energy in a co-located situation within a local network by applying semi-dispatch caps at the common point of coupling to the constrained network and not at an individual asset's connection point.	Many VRE resources have been established through PPAs, where there is a contractual obligation to export as much as possible to the grid. This fact needs to be taken into consideration to avoid disincentivising deployment of ESS.	An aggregated hybrid model offers advantages but not the preferred option if co-located assets must adopt this model. If AEMO pursue Option 2a, it should be optional for participants to use this approach i.e. the hybrid model, and its associated obligations, should not be forced onto all co-located assets.	Suggest flexibility to register as generation, load or hybrid categories and for AEMO to consider staged construction when registering ESS. It's unclear as to how model would be impacted if solar farm is partly non-scheduled & partly semi-scheduled.	Option 2 can act as a single resource ID for a hybrid integrated system and option 1 can act as separate resource ID.	There is benefit from being able to aggregate hybrid systems and offer them to the NEM as a single resource	
7	Refer to Table 8 (section 2.4.2), are there other potential challenges and risks associated with option 1?					See response to question 1				Aggregation of locations may add another challenge in the MLF assessment		
8	Refer to Table 9 (section 2.4.2), are there other potential challenges and risks associated with options 2a and b?			Option 2a needs to ensure that it doesn't introduce unnecessary complexity for plant operators. It may be appropriate to develop Option 1 as well as Option 2, with the intention that Option 2 will be implemented at a later date.	If AEMO continues to explore the hybrid model, this should not result in a mandated approach where all ESS systems must register as a hybrid. To do so could greatly complicate participants' ability to bid co-located assets. Participants should be allowed some degree of discretion	See response to question 1		Option 2a creates complexities for dispatch compliance for intermittent assets co-located with scheduled units. This creates complex forecasting requirements. If AEMO pursue this, it should be an optional approach.	Hybrid category may add complexity, especially in application/registration.	Challenges include: 1. Defining tariff for energy, FCAS and other ancillary services within a single hybrid facility 2. Option 2b needs to please both signals from an offtake arrangement and signals from the grid for FCAS		

ID	Question	AGL	ARENA	Australian Energy Council	CEC	Edify	ENEL	Energy Australia	Energy Queensland	GE	Hydrostor	Hydro Tasmania
					as to how it registers an ESS							
9	Do you have any views on AEMO's proposed approach to implement a single participation model to integrate ESS?	Encourage AEMO to progress the option with some reservations.. Queries: • Can participants make modifications to registration at a later date? • Will this category be mandatory for hybrid generation systems? This may unintentionally add additional complexity and cost for some participants an may erode some benefits of a co-located ESS • Additional flexibility should be provided to support multiple ESS technologies within the same connection point (i.e. for example compressed air + metals based battery)	It is important any new registration framework provides flexibility for different commercial models and works to encourage new investments that strengthen the power system.		Suggest a facility that converts electricity into something else (i.e. a load) is not able to register under the new category to avoid network charges, given that it consumes electricity and should be charged.	A single participation model does introduce some complexities, particularly managing differences in MLF and non-continuous resource considerations. A mandatory functional check could be performed prior to submission of offers to prevent conflicts between generation and load offers. Particularly where offers from ESS will increasingly be made by automatic bidding computer software, the complexities of having separate generation and load offers may be manageable.			Stream 1 and 2 would both provide practical methods of implementing a single participation model.	A single participation model reduces complexity. Suggest more elaboration on the ancillary services such as voltage control, spinning reserve and flexible ramping, to make multiple service provision by ESS within a single participation model be much easier and clearer.	Agree with AEMO	
10	Do you have any views on the proposed key requirements AEMO has identified for an ESS participation model?	Refer question 5			AEMO's proposal for new information requirements appear practical to improve AEMO's visibility on system operations. However, this information should be confidential for AEMO's use only.	The storage capacity of batteries will erode over time. Participants should be able to update this variable over time without needing to renegotiate their GPS.	Better and more detailed information on the energy reserves for each ESS could benefit AEMO as a market operator. However, further information requests would increase costs for both AEMO and market participants. It is not clear that all this information is necessary to operate the system, particularly if stand-alone ESS or hybrid systems register as scheduled generators and provide dispatch forecasts in advance. AEMO should confirm whether all information requested is necessary to operate the system. It should clarify why it would need to place additional requirements on hybrid and stand-		Suggest more clarity is needed around the hybrid-class technical requirements versus standalone ESS, particularly regarding performance standards & registration. AEMO should consider projects seeking to reduce energy consumption through solar/ESS that may not necessarily wish to participate in, or export to the market. These projects could be managed with a more restrictive operational mode.	New information requirements may be beneficial. The status of <5MW ESS is unclear until registration. Developers may not have all the required information in the project development stage. These requirements increase risk - consider allowing developers to submit less thorough information while working towards Connection Application and to determine viability, then later to submit full information. - Transmission network & distribution network connected ESS should be differentiated due to differences in interconnection	Include additional inputs such as real and reactive power capacities and limits.	

ID	Question	AGL	ARENA	Australian Energy Council	CEC	Edify	ENEL	Energy Australia	Energy Queensland	GE	Hydrostor	Hydro Tasmania
							alone ESS that are not placed on 'traditional' scheduled generators.			access & fortification arrangements.		
11	Do you have any views on whether existing ESS should be transitioned to the proposed participation model (see section 2.4.2, option 2b)?						Provided risks that were not contemplated at the time of financing of the ESS are not introduced and the cost of making these transitions is nil, then Edify Energy is cautiously open to existing ESS transitioning to new arrangements				Model not always applicable - available products for ESS (EG: load shift, arbitrate) may not be the same for integrated Hybrids. Existing ESS should be given the option to transition to the proposed model to recognise benefits & make it fairer for them to participate in NEM.	
12	What are your views on how to integrate ESS into the NEM's recovery mechanisms?	Supports charging non-energy recovery and NEM participant fees and costs to ESS operators. Regarding TUOS charges: system charges should apply to all point-in time system loads, including to ESS. Application of a blanket TUOS exemption on all ESS would effectively be a subsidy on ESS, creating a market distortion and unfair technological advantage. Recognises the complexities associated with ESS, the different ways in which an ESS can be used (i.e. generator, customer, transient source or hybrid), and the unique benefits it can provide to the wider system. Supports the need for a closer review on network charging arrangements applicable to ESS and its different modes of operation, across the transmission and distribution systems.		There are no issues raised regarding the proposed recovery arrangements. Any proposed rule should attempt to treat the storage consistent with the underlying economic principles that led to the current approach to charging customers rather than generators. The existing rules provide the TNSPs a clear objective in seeking to apply network charging efficiently for each user and gives them considerable latitude for doing so, ultimately overseen by the regulator. For some business models zero TUOS charging will be correct, but in other cases TUOS charges equivalent to conventional transmission customers would be appropriate.	Agree that a permanent approach to the network charging arrangements applicable to ESS is needed and this warrants a more holistic review of how network costs are recovered. On a principles basis, suggest a facility that converts electricity into something else (i.e. a load) is not able to register under the new category to avoid network charges, given that it consumes electricity and should be charged. Clarity should be provided as to whether some of the proposed NEM fees categories and whether all the suggested Market Customer elements are relevant for ESS purposes.		Supports AEMO's position on TUOS charges for battery systems over 5MW. ESS reduce transmission network use during peak times & provide system services, reducing the cost of/need for transmission investment. ESS TUOS reflect costs of new network investment, but ESS don't charge when network use is as its peak. Encourages AEMO to consider whether it's appropriate to charge smaller ESS TUOS.	Greater thought needed on NEM participant fees, whether all customer related fees are relevant. TUOS not appropriate for ESS & review of network tariff framework needed. Suggests reviewing DUOS charges. DB networks have proposed flat demand tariffs - they don't adequately signal price.	ESS should be treated equitably compared to other categories. It's unclear as to whether DUOS would be considered similarly to TUOS. The delineation of applicable network charges assists with project development & may influence the manner in which ESS is connected.	Recovery mechanisms don't seem to differentiate between behind and front of meter. ESS is both a market customer and market generator, but should avoid double-charging ESS to ensure technology-neutrality. ESS should be charged on the basis of exported electricity to grid - storage shouldn't be charged TUOS. - Agree that TUoS charge regime should be holistically reviewed.	Consideration should be given to treatment of cost allocation of distributed energy resources capable of providing both regulated and unregulated services in the NEM	To charge TUOS for scheduled systems such as pumped hydro would be inefficient, likely distort investment signals and would not align with the need for significantly more storage investment across the NEM.

Appendix B. Overview of key NER Chapter 2 and 3 changes

Key areas	Overview of key changes
ESS definition	The proposed ESS definition (termed bi-directional unit) is technology neutral to allow for different storage technologies, e.g. pumped hydro, batteries, flywheels, to be covered by the definition.
New participant category and registration	A person with an ESS or 'hybrid' facility would register as a Bi-directional Resource Provider. This could include: • ESS only, this would be classified as scheduled and market. • ESS and a combination of assets including a scheduled generating unit, semi-scheduled generating unit or load. Load and generating unit. If an ESS is unable to transition linearly from production to consumption, meaning it cannot submit a single dispatch bid, the ESS would be classified as a scheduled generating unit and scheduled load. Similar to the arrangements for generating systems, AEMO would have a power to exempt persons with 'hybrid' facilities (termed bi-directional facilities) from the registration requirement; this would include the entire 'hybrid' facility or any plant within it. Where a bi-directional unit is 'exempt', these would be termed small bi-directional units and could be classified by an MSGA.
Exempt ESS	Exempt ESS could be classified by an MSGA.
Central dispatch, pre-dispatch and compliance	An ESS asset would participate in central dispatch as a single asset (with one DUID). If an ESS asset cannot participate in central dispatch as a single DUID due to technical constraints (pumped hydo units may have an operating deadband), it would instead participate as a scheduled load (DUID 1) and scheduled generating unit (DUID 2). Typically, plant within a bi-directional facility would separately provide a dispatch bid for a: • Scheduled bi-directional unit. • Scheduled generating unit or semi-scheduled generating unit. • Scheduled load. Existing NER provisions apply to the individual assets (e.g. more than one bi-directional unit) can be aggregated. Currently, aggregation of different asset classifications is not possible. While this is made clearer, it should be noted that AEMO's draft rule allows flexibility for AEMO to consider different technology types and classifications to be aggregated within a 'hybrid' facility if AEMO approves it and there is no adverse impact on central dispatch. Current NER compliance obligations of scheduled plant would apply to an ESS.
Metering	Existing NEM metering obligations would apply to a Bi-directional Resource Provider. This requirement is for a metering installation at the relevant connection point. SCADA data would be required for all assets in a bi-directional facility.
Settlements/prudentials	Existing settlement and prudential arrangements are proposed to apply to a Bi-directional Resource Provider. These are applied at the company level.
Fees, charges and non energy cost recoveries	AEMO proposes that ESS is not charged TUOS, but is charged DUOS on its consumption. Non-energy cost recoveries (FCAS, SRAS, compensation etc), Bi-directional Resource Provider and MSGA recovered from based on consumed energy (import metering data) and sent out energy (export metering data) to the grid, not gross energy (net metering data).
Network losses and constraints	Existing network losses and contraints arrangements are proposed to apply MLFs are calculated for a registered participant at the connection point in accordance with AEMO's Forward-Looking Transmission Loss Factor methodology. Typically, where there are bi-directional flows two loss factors will be calculated.
Performance standard	Currently, a single performance standard, applicable at the connection point. AEMO considers that it is no longer appropriate to base performance standards on the registered participant category as it is expecting to see more ESS and bi-directional facilities. AEMO proposes that a registered participant's performance standard should be based on its assets.

Glossary

This document uses terms and abbreviations that have meanings defined in the National Electricity Rules (NER). The NER meanings are adopted unless otherwise specified.

Term/abbreviation	Definition
AEMC	Australian Energy Market Commission.
AER	Australian Energy Regulator.
AGC	automatic generation control.
ARENA	Australian Renewable Energy Agency.
CEC	Clean Energy Council.
CoGATI	AEMC's Co-ordination of Generation and Transmission Investment Review.
DUID	dispatchable unit identifier.
DUOS	Distribution use of system.
EGES	Emerging Generation and Energy Storage.
ESS	Energy storage system.
FCAS	frequency control ancillary services.
FRMP	financial responsible Market Participant.
'hybrid' system	A system connected to the national grid and includes ESS coupled with a generating system and/or load.
MASS	Market Ancillary Services Specification.
MLF	marginal loss factor.
MSGA	Market Small Generation Aggregator.
NEL	National Electricity Law.
NEM	National Electricity Market.
NER	National Electricity Rules.
NMI	national metering identifier.
NSP	Network Service Provider.
PV	photovoltaic.
RERT	Reliability and Emergency Reserve Trader.
RRO	Retailer Reliability Obligation
SCADA	supervisory control and data acquisition.
stand-alone ESS	An individual ESS that is connected to the national grid.
TUOS	transmission use of system.
VRE	variable renewable energy.