Participation Guideline for Energy Storage Systems in the WEM

This document provides an overview of how utility-scale energy storage systems (ESS) can participate in the Wholesale Electricity Market (WEM) under the current regulatory framework (as at May 2019) and based on the existing capabilities of AEMO's current market and dispatch systems. AEMO has published a complementary information paper, *Interim Pathway to Enable the Registration of Energy Storage Systems in the WEM*, which is available from the Market Design and Operations Working Group webpage.[1]

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1. Introduction

1.1 Purpose

This document provides an overview of how utility-scale ESS can participate in the WEM under the current regulatory framework and based on the existing capabilities of AEMO's current market and dispatch systems.

1.2 Background

AEMO has received enquiries from ESS proponents seeking to understand how they can participate in the WEM.

This document provides an overview of how ESS can participate in the WEM under the current regulatory framework and based on the existing capabilities of AEMO's current market and dispatch systems. It sets out AEMO's views regarding the relevant provisions in the WEM Rules and how they apply to ESS. It also considers factors that may enable or hinder the effective registration, connection and participation of ESS.

It is important to note that the current regulatory framework will change as a result of the WA Government's Energy Transformation Strategy that was announced on 6 March 2019.[2] Therefore, the options and associated

[1] https://www.erawa.com.au/rule-change-panel-mdowg

[2] https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/03/McGowan-Government-launches-Energy-Transformation-Strategy.aspx

arrangements outlined in this document are necessarily provisional and subject to any changes resulting from the Energy Transformation Strategy.

This document only considers utility-scale ESS, connected at a single connection point in the South West Interconnected System (SWIS). This connection point may consist solely for the particular ESS, or may include other assets at the same connection point. This document does not consider distributed ESS solutions, such as Virtual Power Plants (VPPs).

1.3 Definitions and frequently asked questions

Capitalised terms that are not defined (like "Registered Facility") have the meaning given in the WEM Rules unless otherwise stated. Table 1 defines additional terms used in this document that are not defined in the WEM Rules.

Table 1 Glossary

Term	Definition
AGC	Automatic Generation Control
Balancing basepoint	The MW value that a Balancing Facility is dispatched to, and operates at, before movements resulting from Ancillary Service provision are considered. For non-intermittent Facilities not in the Synergy Portfolio, this is equal to the Dispatch Instruction quantity.
bi-directional energy flows	In respect of a connection point, energy that flows in a way that the connection point may be net positive (exporting) to the SWIS, or net negative (importing) from the SWIS, or net zero, across different time periods
CRC	Certified Reserve Capacity
ETAC	Electricity Transfer Access Contract
export only	In respect of a connection point, energy that flows in a way that the connection point is net positive (exporting) or net zero across all time periods, and never net negative (importing), excluding minor imports due to auxiliary loads
generation-hybrid ESS	An ESS that has one or more additional sources of generation behind the same connection point
generation-Load-hybrid ESS	An ESS that has one or more additional sources of generation and consumption behind the same connection point
import only	In respect of a connection point, energy that flows in a way that the connection point is net negative (importing) or net zero across all time periods, and never net positive (exporting)
Load-hybrid ESS	An ESS that has one or more additional consumption behind the same connection point
LRR	Load Rejection Reserve Service
MR	Market Rule (i.e. WEM Rule)
PUO	Public Utilities Office
RTDE	Real-Time Dispatch Engine
SCADA	The Supervisory Control and Data Acquisition system
SRAS	Spinning Reserve Service
stand-alone ESS	An ESS that has no other sources of generation or consumption behind the same connection point

What is energy storage?

In the context of the WEM, energy storage is capable of consuming, storing, and discharging electrical energy. An example of energy storage is a battery that stores electrical energy in chemical or electrochemical cells, which can then be converted back to electrical energy as needed.

What is an energy storage system?

The term 'energy storage system' (ESS) describes one or more energy storage assets that are electrically connected to the SWIS at the same connection point. An ESS can be a stand-alone facility, part of a hybrid facility that includes other types of generating plant, such as wind turbines or solar photovoltaics (PV) and inverters, or embedded with one or more loads.

AEMO considers that, depending on the physical characteristics of the Facility, an ESS may be considered a "generation system" or a "Load" as described in MR 2.29.1. The corresponding Facility Class (if any) as described in MR 2.29.2 will also depend on the physical characteristics of the Facility. Examples are presented in section 3 below.

Does an ESS always have to be a Registered Facility in the WEM?

This depends on the size of the battery system and the operational arrangements for charging and discharging. Anyone that owns, operates, or controls a generation system with a rated capacity of 10 MW or above will need to register this generation system as a Scheduled Generator or a Non-Scheduled Generator (MR 2.29.4). Further information is provided in section 2.1 of this document.

Can I retrofit an ESS to an existing Registered Facility?

Yes, but there are special considerations associated with this option. Please see section 2.2 of this document.

Can I register an ESS in multiple Facility Classes?

No. Clause 2.29.2 of the WEM Rules prevents a Facility from being registered in more than one Facility Class simultaneously. The WEM Rules and AEMO's market and dispatch systems depend in many respects on this fact, and significant rework of the WEM Rules and AEMO's systems would be required to allow a Facility to be simultaneously registered in multiple Facility Classes.

Will ESS participation in Balancing and Ancillary Services differ from other Registered Facilities?

AEMO is not proposing any changes to current Balancing or Ancillary Services arrangements to specifically cater for ESS participation until the changes resulting from the Energy Transformation Strategy are implemented. Some of the operational limitations or challenges that may arise from this are discussed later in this document.

Are ESS eligible for Capacity Credits?

Yes, in limited circumstances. See section 2.3 for more information.

How do I register in the WEM?

For information on how to register as a Market Participant, or to register a new Facility, please see AEMO's website at http://aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Participant-information.

2. ESS participation considerations

2.1 ESS and Intermittent Generation

The definitions of "Scheduled Generator", "Non-Scheduled Generator", and "Intermittent Generator" in the WEM Rules affect the ability of certain configurations of ESS and ESS-hybrid facilities to register under certain Facility Classes.

AEMO's view is that an ESS could fulfil any of these definitions, depending on its physical characteristics.

AEMO considers that an ESS-hybrid facility can be deemed an Intermittent Generator if, within a single Trading Interval, that Facility's output cannot be controlled within the Tolerance Ranges that would apply to a Scheduled Generator of the same rated capacity, due to factors beyond the control of its operator. Consider two examples:

- A stand-alone ESS with a rated capacity of 30 MW; and
- A generation-hybrid ESS with 100 MW of wind generation capability and 1 MW / 1 MWh of energy storage capacity.

For the first example, at any point in time, this Facility can "increase or decrease the quantity of electricity it generates"[3] and has control of this output, subject to the quantity of remaining charge within the energy storage medium. On this basis, AEMO considers that this Facility does not meet the definition of an Intermittent Generator. Therefore, it must register as a Scheduled Generator, as per section 3.3.2 of this document.

For the second example, while a portion of this Facility is 'schedulable', nearly all its generation capacity comes from an intermittent source (wind). Based on the relative sizes of these energy sources (i.e. 100 MW of intermittent capacity versus 1 MW of energy storage capacity), AEMO would treat this Facility as an Intermittent Generator.

As at the time of publication of this document, AEMO has not determined a specific limit on where a Facility would transition to being considered an Intermittent Generator, but permanent criteria would be required to be determined prior to registration of ESS. This determination would need to consider multiple factors related to the controllability and predictability of the operation of both generation assets, loads, and energy storage at the connection point.

2.2 Retrofitting ESS to an existing Facility

Currently, existing operational Facilities in the WEM could potentially retrofit an ESS at the same connection point, subject to considerations such as:

- Whether the Facility complies with the applicable Technical Rules requirements.
- The requirements related to Facility aggregation in MR 2.30 (including the criteria in MR 2.30.5).
- The implications for CRC and Capacity Credit levels.
- If the Facility that is to be retrofitted is an intermittent Non-Scheduled Generator, the size of the ESS relative to the existing Intermittent Generator ,and the implications for the Facility's ability to be 'scheduled' as discussed in section 2.1 of this document.

If a Facility's characteristics change substantially, it may be appropriate for the Facility to change its registration category. In effect, this would mean registering a new Facility in the appropriate Facility Class, and de-registering the old Facility. Under the current WEM Rules, a Facility's registration under a Facility Class is considered only at the time of registration. This means AEMO has no ability under the current WEM Rules to amend a generator's Facility Class if its characteristics change (for example, a Facility's ability to be scheduled).

[3] Definition of Scheduled Generator in the WEM Rules.

2.3 Eligibility for Capacity Credits

An ESS's eligibility to receive CRC and, subsequently, Capacity Credits will depend on its Facility Class. Market Participants applying for CRC must submit all required information, for the relevant Facility Class, under MR 4.10.1. Further information about applying for CRC can be found in the Market Procedure: Certification of Reserve Capacity[4].

2.3.1 Scheduled Generator

For a Scheduled Generator, AEMO assesses the quantity of capacity likely to be available during Peak Trading Intervals (MR 4.11.1(a)). This includes assessments of (among other things):

- The amount of fuel available or likely to be available (MR 4.10.1(e)(v)(2)).
- The level of network access (MR 4.11.1(bA)).
- Outage rates (or expected outage rates for a new Facility) (MR 4.11.1(h)).

For an ESS, AEMO considers fuel to be equivalent to energy storage capability. As such, a battery must demonstrate that it can discharge continuously for Peak Trading Intervals at the level of CRC sought, as well as meeting the other relevant information requirements of MR 4.10.

2.3.2 Intermittent Non-Scheduled Generator or Non-Scheduled Generator

Intermittent Non-Scheduled Generators and Non-Scheduled Generators are assigned CRC equal to the Relevant Level as determined in accordance with the Relevant Level Methodology described in Appendix 9 of the WEM Rules (MR 4.11.2). While the current Relevant Level Methodology was not originally designed to cater for ESS, AEMO considers that no changes to existing rules or systems are required to use this methodology for ESS.[5]

An application for CRC in respect of a Facility that has not been operational for the full five-year period for the purposes of the Relevant Level calculation is required to provide a report prepared by an expert accredited[6] by AEMO (MR 4.10.3)[7]. ESS proponents are encouraged to approach AEMO in the early stages of their project to discuss the methodology of the expert report to ensure it is appropriate for the purposes of the CRC application.

2.4 Outage submission and planning

AEMO considers that the current outage submission process in the WEM Rules is adequate for ESS as an interim arrangement. Obligations will apply to an ESS according to its Facility Class. AEMO will apply existing processes and rules to determine if an ESS needs to be included on the Equipment List, and therefore if it will be subject to outage scheduling.

2.5 Balancing Market Participation

An ESS that is registered under the existing WEM framework would participate in the Balancing Market on the same terms as existing Facilities registered in the relevant Facility Class (if any).

Existing Balancing Gate Closure (currently two hours) will apply to bids in relation to ESS. Under the current WEM Rules, there would be no mechanism or requirement for an operator of an ESS facility to schedule its charging, beyond ensuring it has a Dispatch Instruction for zero MW when doing so. Any non-zero Dispatch Instruction quantity would require the ESS to generate electricity (discharge) net to the SWIS, and therefore it could not charge from the SWIS while this Dispatch Instruction was in effect, assuming no movements due to the provision of Ancillary Services by the ESS. Additional considerations on this point are in section 2.6 of this document.

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[4] Available at http://aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Procedures.

[5] The ERA has recently completed a review of the Relevant Level Methodology, which may have implications for its future application to ESS. More information can be found at https://www.erawa.com.au/electricity/wholesale-electricity-market/methodology-reviews/review-of-method-used-to-assign-capacity-to-intermittent-generators-2018.

[6] The list of accredited experts is available on AEMO's website at http://aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Reserve-capacity-mechanism/Certification-of-reserve-capacity.

[7] AEMO has published a guide for independent expert reports, which can be accessed at http://aemo.com.au/-/media/Files/Electricity/WEM/Reserve_Capacity_Mechanism/Certification/2019/Information-guide-for-independent-expert-reports-in-the-Reserve-Capacity-Mechanism.pdf.

The operator of an ESS facility registered as a Scheduled Generator or a Non-Scheduled Generator will need to ensure that its Balancing Submissions correctly reflect the available capacity of the ESS for a given Trading Interval, considering the state of charge of the ESS and its capacity to deliver a continuous power output within its Tolerance Range for the entire duration of the Trading Interval.

Under MR 7A.2.8, all Market Participants have an obligation to ensure that any Balancing Submissions prior to Balancing Gate Closure accurately reflect all information reasonably available to the Market Participant. This obligation applies to all Balancing Facilities, (that is, Scheduled Generators and Non-Scheduled Generators, including intermittent Non-Scheduled Generators).

2.6 ESS dispatch, forecasts, and power system security implications

At present, there are no specific obligations in the WEM Rules that would require a Market Participant to notify AEMO of when it intends to consume energy to charge an ESS. Forecast data is provided to AEMO on a voluntary basis by several large Loads in the SWIS to assist with operational forecasting. AEMO may request similar data from an ESS, depending on its size and impact on operational demand.

Prior to the implementation of the broader Energy Transformation Strategy, AEMO will monitor the aggregate charging capability of all connected utility-scale ESS. If this becomes significant, interim measures may need to be introduced to maintain Power System Security and Power System Reliability where multiple ESS begin charging at the same time. AEMO may require certain conditions to be applied to an ESS to ensure its operation does not materially affect Power System Security or Power System Reliability.

2.7 LFAS participation

2.7.1 Current AEMO system limitations

At present, Facilities providing LFAS in the WEM are sent signals via SCADA from AEMO's AGC system. When frequency drifts outside a defined dead-band, the AGC system apportions MW quantities to participating LFAS Facilities to maintain system frequency at or close to 50 Hz.

AEMO's WEM AGC system operates only in positive MW quantities. The system is not currently configured to dispatch Facilities to quantities less than zero.

This limitation would prevent an ESS from providing LFAS while charging (net importing from the SWIS), limiting the capability of the Facility to participate fully in the LFAS Market. There may be workarounds for this issue, but AEMO has not confirmed their feasibility at this stage.

There is also a potential system issue in AEMO's RTDE for the WEM and its ability to appropriately consider LFAS provision by Non-Scheduled Generators. After Balancing Gate Closure has occurred, the bid quantities for intermittent Non-Scheduled Generators are replaced by a value based on AEMO's persistence forecast for the Facility. This value is used as a Balancing basepoint to recalculate the Balancing Merit Order, and to send an updated Dispatch Instruction to next in-merit Facility in the Balancing Merit Order, assuming no Out of Merit dispatch is required. As LFAS is enabled through creating a high and low operating limit, based around a fixed dispatch Balancing basepoint (which is the persistence forecast value and not the Dispatch Instruction), AEMO would need to revisit the methodology of how the RTDE treats Non-Scheduled Generators and the implications of any changes for other processes and systems. While this issue exists, participation of ESS registered as Non-Scheduled Generators, including intermittent Non-Scheduled Generators, in the LFAS Market may not be feasible.

AEMO is currently transferring existing systems from Western Power to AEMO as part of the System Management Systems Transition (SMST) project. As a result, it is unlikely that AEMO will be able to implement any significant changes to its dispatch systems until at least 2020. At present, AEMO does not have a time or cost estimate for the changes (including potential interim workarounds) required to enable ESS to fully participate in the LFAS Market across both its charging and generation capability.

2.7.2 Current WEM Rule issues

MR 7A.3.5(b) requires any quantity of capacity, equal to the downwards LFAS Enablement of the Facility for that Trading Interval, for the provision of downwards LFAS, plus any minimum generation quantity (item (b)(xiii) of Appendix 1), to be bid at Minimum STEM Price. This is an impediment to ESS providing downwards LFAS for negative quantities.

As an example, a stand-alone ESS Facility with a 30 MW / 60 MWh capacity is currently at 0 MW output and a charge state of 30 MWh. The Facility can charge and discharge at the same rate. In theory, it could provide 30 MW of upwards LFAS and 30 MW of downwards LFAS, supplying these by charging or discharging, as necessary, assuming no technical issues in transitioning across the 0 MW point. However, under the current wording of MR 7A.3.5(b), an ESS would have to bid 30 MW into the Balancing Market if it is cleared at the Minimum STEM Price for 30 MW of downwards LFAS. This would prevent an ESS from providing its full range of LFAS capability for any given Trading Interval.

The definition of "LFAS Submission" in the WEM Rules also presents a rule impediment to the provision of Upwards LFAS by Non-Scheduled Generators. An LFAS Submission for a Non-Scheduled Generator is only for quantities able to be "activated downwards". AEMO's interpretation of this definition is that only Scheduled Generators can make submissions of upwards LFAS, but both Scheduled Generators and Non-Scheduled Generators can make submissions for downwards LFAS. This definition will restrict any ESS registered in the Non-Scheduled Generator Facility Class from providing upwards LFAS.

2.8 SRAS participation

SRAS can be provided by Scheduled Generators or Interruptible Loads (MR 3.9.2). Synergy is the default provider of SRAS, but AEMO may procure SRAS from other Rule Participants where Synergy cannot meet the Ancillary Service Requirements with its Registered Facilities, or AEMO can procure SRAS that is a less expensive alternative than Synergy's Registered Facilities (MR 3.11.8). Historically, AEMO has tendered for SRAS each year for the next financial year.

The requirements and conditions that AEMO considers for the provision of SRAS by Rule Participants, other than Synergy, are outlined in more detail in AEMO's latest Request for Expressions of Interest for SRAS and LRR[8]. An ESS that meets the technical requirements to provide SRAS could tender for provision of this service and would be considered under the relevant tender conditions.

2.9 LRR participation

As per MR 3.9.6, LRR is provided by Scheduled Generators. Any ESS that wishes to provide LRR will need to be registered as a Scheduled Generator.

AEMO has the option to run a tender process for acquisition of LRR in accordance with MR 3.11.8A and MR 3.11.9, and has asked for expressions of interests from Rule Participants who wish to provide LRR under contract. This expressions of interest round closed on 15 March 2019, and responses will be used to inform AEMO whether there is a benefit to tendering for LRR services to be provided under contract for the 2019-20 financial year[8]. In deciding whether to tender for LRR, AEMO will consider the impact on WEM costs from procuring LRR from Rule Participants other than Synergy, who is the default provider of LRR.

In the event AEMO determines that tendering for LRR is appropriate, a Rule Participant with an ESS, that meets the technical requirements to provide LRR, could tender for provision of this service.

2.10 Settlement

Settlement quantities for ESS will be calculated under the current rules for the relevant Facility Class that the ESS is registered in.

[8] For more information, see https://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Security-and-reliability/Ancillary-services.

Under the current WEM Rules (MR 9.13.1), a Rule Participant with an ESS will pay Market Fees for both the energy consumed to charge the ESS and for the energy discharged, where this occurs in separate Trading Intervals. Consumption and generation within a single Trading Interval will be netted off, and Market Fees will only be charged on the net quantity of generation or consumption.

3. Registration scenarios

3.1 Preliminaries

MR 2.29.1 lists the categories of Facilities for the purposes of the WEM Rules. Of the Facilities listed in this clause, AEMO considers that an ESS may be either a generation system or a Load, depending on the nature of its connection and how it is operated.

Certain Facility Class registrations require a participant to be registered as either a Market Customer or a Market Generator. An entity registered as a Market Customer may also be registered as a Rule Participant in another classification (MR 2.28.12).

The examples in this section of this document assume that the Rule Participant is registered in the appropriate Market Participant class for the relevant Facility Class, where applicable.

The examples below are illustrative, but not exhaustive. They are provided simply as a guide to the arrangements that may be appropriate for certain forms of WEM participation.

3.2 For all scenarios

Currently, the WEM operates on the basis that:

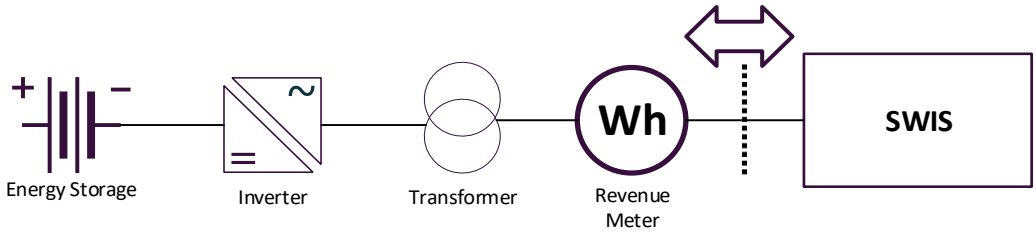
- There is a single financially responsible Market Participant (FRMP) for each identified connection point at which a generating system or Load is connected to the grid.
  - An ESS proponent who chooses not to register the ESS under a Facility Class must still have a FRMP (typically a Market Customer) who settles items including energy, Reserve Capacity costs, and Market Fees for the ESS's connection point.
- A metering installation, which is compliant with the Electricity Industry (Metering) Code 2012,[9] must measure electricity flows at each connection point.

A summary of the possible avenues for ESS participation in the WEM are outlined in Tables 2 and 3. Where it is indicated in Table 3 that there is an option to participate in certain Ancillary Services, participation is not guaranteed. The tables merely indicate if participation is permitted under the current WEM Rules. Some Ancillary Services are procured via tender, and not all tenderers are guaranteed to be successful. Similarly, LFAS participation requires a Facility be certified by AEMO as per the Ancillary Services Power System Operation Procedure[10]. Additionally, AEMO currently has certain system limitations that may affect effective participation of ESS in the provision of Ancillary Services. This issue is addressed in section 2.7 of this guideline.

3.3 Stand-alone ESS

Note that a stand-alone ESS is not considered to be an Intermittent Generator (see Section 2.1 of this document).

Figure 1 A stand-alone ESS Facility



[9] Available from http://www.slp.wa.gov.au/gazette/gazette.nsf/gazlist/12CD08688E37922E48257ACC00233250/$file/gg225.pdf.

[10] Available from https://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Procedures.

3.3.1 Total generation rated capacity < 10 MW

Under MR 2.29.4(c) and (d), a Market Generator who owns, operates, or controls a stand-alone ESS (i.e. not an Intermittent Generator) with a rated capacity of more than 0.2 MW but less than 10 MW, that meets the requirements of MR 2.29.6, may register as a Scheduled Generator or, alternatively, if the stand-alone ESS has a rated capacity of more than 0.005 MW it must be registered as a Non-Scheduled Generator.

3.3.2 Total generation rated capacity ≥ 10 MW

As per MR 2.29.4(b), a Market Generator that owns, operates, or controls a generation system with a rated capacity that equals or exceeds 10 MW and is not an Intermittent Generator must register that generation system as a Scheduled Generator.

3.4 Generation-hybrid

A generation-hybrid ESS may or may not meet the definition of an Intermittent Generator, depending on the nature and rated capacity of the additional behind-the-meter generation (see Section 2.1 of this document).

Figure 2 A wind hybrid ESS Facility (export only)

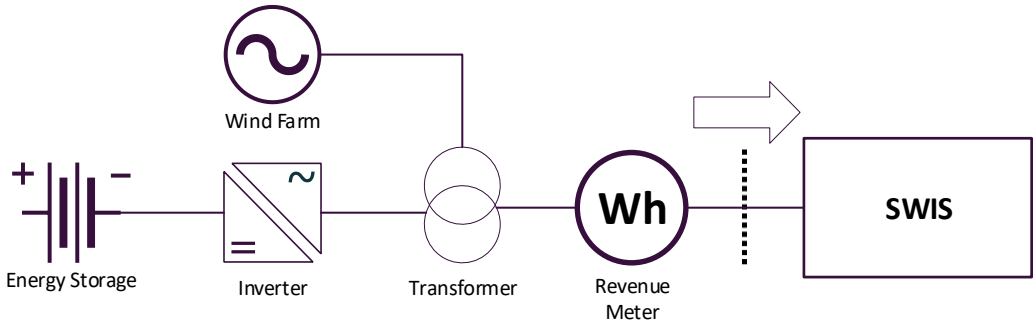
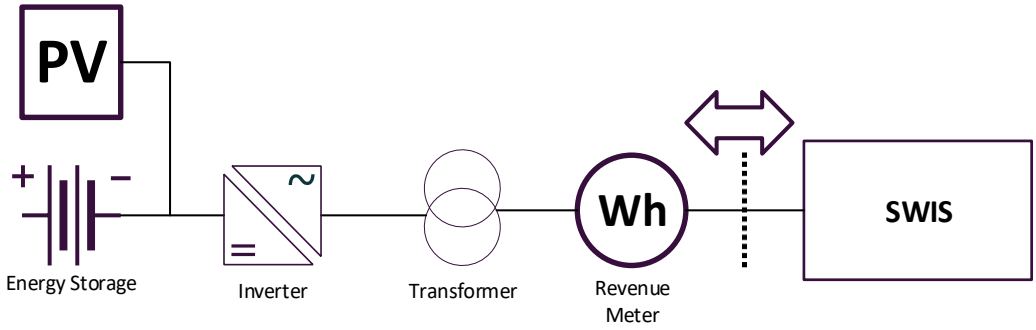


Figure 3 A PV-hybrid ESS Facility (bi-directional)



3.4.1 Total generation rated capacity < 10 MW and net export only

If this Facility does not meet the definition of an Intermittent Generator, it may be registered as a Scheduled Generator or must be a Non-Scheduled Generator, as per MR 2.29.4(c) or (d). Alternatively, if the Facility is an Intermittent Generator, that is, it cannot be scheduled because its output level is dependent on factors beyond the control of the operator, it must be registered as a Non-Scheduled Generator.

3.4.2 Total generation rated capacity ≥ 10MW and net export only

If this Facility does not meet the definition of an Intermittent Generator, it must be registered as a Scheduled Generator as per Section 3.3.2 of this document and MR 2.29.4(b). Alternatively, if the Facility is an Intermittent Generator, it must register as a Non-Scheduled Generator.

3.4.3 Total generation rated capacity <10 MW and bi-directional energy flows

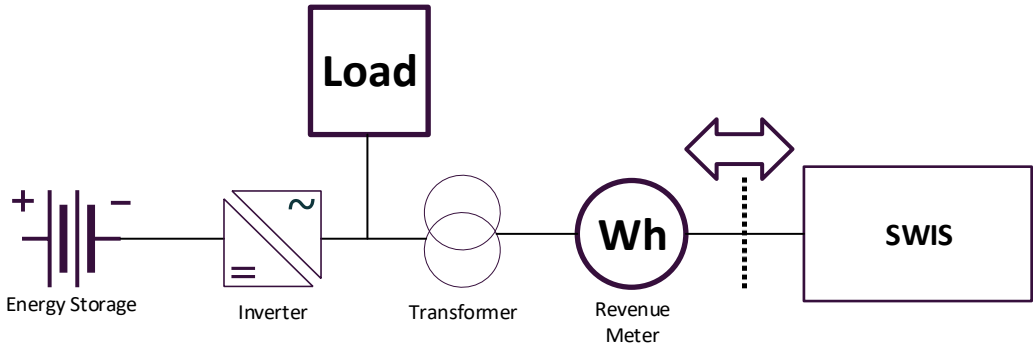
The same requirements apply to this Facility as in Section 3.3.1 of this document.

3.4.4 Total combined generation capacity >10 MW and net bi-directional energy flows

The same requirements apply to this Facility as in Section 3.3.2 of this document.

3.5 Load-hybrid

Figure 4 A Load--hybrid ESS Facility (bi-directional)



3.5.1 Total generation rated capacity < 10 MW and net import only

AEMO considers this Facility should be deemed to be a Load in accordance with the definition in MR 2.29.1(d). Subject to meeting the requirements of MR 2.29.5(a), this Facility may be registered as an Interruptible Load if it "has equipment installed to cause it to be interrupted in response to under frequency situations". AEMO considers that certain ESS control settings may fulfil this requirement, if they respond in appropriate timeframes[11]. Each Facility would be required to be assessed on a case-by-case basis.

3.5.2 Total generation rated capacity ≥ 10 MW and net import only

While this permutation of assets would not normally export to the SWIS, AEMO would require it to be registered as a Scheduled Generator under MR 2.29.4(b). This is to ensure AEMO has suitable visibility of the Facility's output and operation for Power System Security purposes. This is similar to the treatment of most other embedded generation in the SWIS.

3.5.3 Total generation rated capacity < 10 MW and bi-directional energy flows

As per Section 3.3.1 of this document, and subject to the limitations in MR 2.29.4(c) and (d), this Facility may be registered as a Scheduled Generator or, alternatively, must be registered as a Non-Scheduled Generator provided it has a rated capacity over 0.005 MW and is not registered as an Interruptible Load. If the Market Participant is not a Market Generator and the Facility is not an Interruptible Load, the Market Participant may decide to not register this Facility in a Facility Class. In this situation, the facility would be treated as a Load. This is the default treatment of all connect points in the WEM that are not registered in a Facility Class.

3.5.4 Total generation capacity ≥ 10 MW and bi-directional energy flows

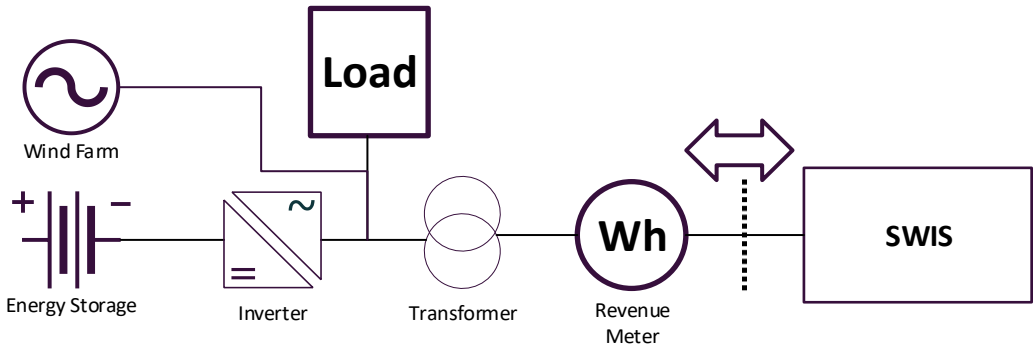
If this Facility does not meet the definition of an Intermittent Generator, it must be registered as a Scheduled Generator as per Section 3.3.2 of this document and MR 2.29.4(b). Alternatively, if the Facility is an Intermittent Generator, it must register as a Non-Scheduled Generator.

[11] The Power System Operating Procedure: Ancillary Services contains the requirements of an Interruptible Load to qualify for provision of Spinning Reserve Service. See https://www.aemo.com.au/-/media/Files/Electricity/WEM/Security_and_Reliability/ancillary_services_psop_july_2012.pdf.

3.6 Generation-load-hybrid ESS

Figure 5 A generation-load-hybrid ESS

Figure 6 Facility (bi-directional)



3.6.1 Total combined generation capacity < 10 MW and net import only

This Facility would be considered a Load, and may additionally be registered as an Interruptible Load if it fulfils the relevant requirements outlined in Section 3.5.1 of this document and MR 2.29.8A.

3.6.2 Total combined generation capacity ≥ 10 MW and net import only

If this Facility does not meet the definition of an Intermittent Generator, it must be registered as a Scheduled Generator under MR 2.29.4(b), if it meets the requirements of MR 2.29.6. Alternatively, if the Facility is an Intermittent Generator, it must be registered as a Non-Scheduled Generator under MR 2.29.4(a).

3.6.3 Total combined generation capacity <10 MW and net export only

As per Section 3.4.1 of this document, if this Facility does not meet the definition of an Intermittent Generator, it may be registered as a Scheduled Generator or, alternatively, must be registered as a Non-Scheduled Generator, provided it has a rated capacity that equals or exceeds 0.005 MW. Alternatively, if the Facility is an Intermittent Generator, that is, it cannot be scheduled because its output level is dependent on factors beyond the control of the operator, it must register as an Intermittent Non-Scheduled Generator.

3.6.4 Total combined generation capacity ≥10 MW and net export only

As per Section 3.4.2 of this document, if this Facility does not meet the definition of an Intermittent Generator, it must be registered as a Scheduled Generator. Alternatively, if the Facility is an Intermittent Generator, that cannot be scheduled because its output level is dependent on factors beyond the control of this the operator, it must be registered as a Non-Scheduled Generator in accordance with MR 2.29.4(d).

3.6.5 Total combined generation capacity < 10 MW and bi-directional energy flows

As per Section 3.3.1 of this document, this Facility may be registered as a Scheduled Generator or a Non-Scheduled Generator, provided it has a rated capacity that equals or exceeds 0.005 MW.

3.6.6 Total combined generation capacity ≥ 10 MW and bi-directional energy flows

If this Facility does not meet the definition of an Intermittent Generator, it must be registered as a Scheduled Generator as per Section 3.3.2 of this document. Alternatively, if the Facility is an Intermittent Generator, it must be registered as a Non-Scheduled Generator, provided it has a rated capacity that equals or exceeds 0.005 MW.

4. Further information

ESS proponents are advised to contact AEMO early in the design phase of their project to confirm the latest registration and technical requirements for ESS. AEMO will work with a proponent and Western Power to ensure SCADA and connection equipment are appropriate for the Facility.

Enquiries can be directed as follows:

- This document – wa.marketdevelopment@aemo.com.au.
- Facility Registration – wa.operations@aemo.com.au.
- Reserve Capacity Mechanism participation (including CRC) – wa.capacity@aemo.com.au.

Table 2 Facility Class Registration options

	Permitted Facility Class Registration options	
Physical arrangement	Generation rated capacity < 10 MW	Generation rated capacity ≥ 10 MW
Stand-alone ESS	Scheduled Generator; Non-Scheduled Generator	Scheduled Generator
Generation-hybrid ESS	Scheduled Generator; Non-Scheduled Generator, Intermittent Non-Scheduled Generator	Scheduled Generator; Intermittent Non-Scheduled Generator
Load-hybrid ESS	Scheduled Generator; Non-Scheduled Generator; Load; Interruptible Load	Scheduled Generator
Generation-Load hybrid ESS	Scheduled Generator; Non-Scheduled Generator; Intermittent Non-Scheduled Generator; Load; Interruptible Load	Scheduled Generator; Intermittent Non-Scheduled Generator

Note: Ability to register as an Intermittent Generator or as a Non-Scheduled Generator will depend on the intermittency of the additional generation source, and its rated capacity relative to the size of the ESS, as discussed in Section 2.1. This table assumes that the Market Participant is registered as a Market Generator and/or a Market Customer to enable the Facility Class registrations outlined in this document.

Table 3 Facility Class Registration requirements and participation allowed under the WEM Rules

Facility Class or category	Scheduled Generator	Non-Intermittent Non-Scheduled Generator	**Intermittent Non-Scheduled Generator**	**Interruptible Load**	None (i.e. a "Load" not registered in any Facility Class)
Rule Participant Class	Market Generator	Market Generator	Market Generator	Market Customer	Market Customer
Maximum ESS Generation Capacity	As per ETAC	< 10 MW combined with non-ESS rated generation capacity	See section 2.1 of this document	< 10 MW combined with non-ESS rated generation capacity	< 10 MW combined with non-ESS rated generation capacity
Maximum ESS Consumption Capacity	As per ETAC	As per ETAC	See section 2.1 of this document	As per ETAC	As per ETAC
Maximum behind-the-meter non-ESS generation	As per ETAC	< 10 MW combined with ESS rated capacity	See section 2.1 of this document	< 10 MW combined with ESS rated capacity	< 10 MW combined with ESS rated capacity
Balancing Participation	Yes – mandatory	Yes – mandatory but restricted – bids at minimum or maximum STEM Price (price-taker)	Yes – mandatory but restricted as per existing Intermittent Non-Scheduled Generators	No – price-taker like other loads.	No – price-taker like other loads.

Facility Class or category	Scheduled Generator	Non-Intermittent Non-Scheduled Generator	**Intermittent Non-Scheduled Generator**	**Interruptible Load**	None (i.e. a "Load" not registered in any Facility Class)
STEM Participation	Yes	Yes	Yes	Yes – as a Market Customer	Yes – as a Market Customer
Upwards LFAS[12]	Yes	No[13]	No[13]	No	No
Downwards LFAS[12]	Yes	Yes	Yes	No	No
Spinning Reserve	Yes	No	No	Yes	No
Load Rejection Reserve	Yes	No	No	No	No
Dispatch Support Service (DSS)[14]	Yes	Yes	Yes	Yes	Yes
Network Control Service (NCS)[15]	Yes	Yes	Yes	Yes	No
System Restart	Yes	Yes	Yes	N/A	No
Capacity Credits	Possible	Possible	Possible – Relevant Level Methodology	N/A	N/A
Outage Submissions	Yes	Yes – unless exempted under MR 3.18.2A	Yes	Yes	No – unless required under MR 3.18.2(c)(iv)

Note: For each of the contracted Ancillary Services (SRAS, LRR, Dispatch Support Service, Network Control Service and System Restart), this document indicates only whether a given registration option is permitted to provide this service under the current regulatory framework. It does not indicate whether a Facility will receive a contract, as this process is currently conducted via tender[16]

[12] The minimum threshold for LFAS participation at present is 10 MW (section 2.1.1(k) of the Ancillary Services Power System Operation Procedure).

[13] As per the definition of "LFAS Submission" in the WEM Rules.

[14] At the time this document was published, no DSS contracts were in place.

[15] NCS contracts are agreed between the Network Operator (Western Power) and a Market Participant.

[16] See here for more information on Ancillary Services tenders: https://www.aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Security-and-reliability/Ancillary-services.