Australian Government

Department of Climate Change, Energy, the Environment and Water

Concept Paper - Energy Storage Systems

Guarantee of Origin Scheme

Cataloguing data

This publication (and any material sourced from it) should be attributed as: DCCEEW 2025, *Concept paper: Energy Storage Systems*, Department of Climate Change, Energy, the Environment and Water, Canberra, February. CC BY 4.0.

This publication is available at https://consult.dcceew.gov.au.

Department of Climate Change, Energy, the Environment and Water
GPO Box 3090 Canberra ACT 2601
Telephone 1800 920 528
Web dcceew.gov.au

Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

Table of Contents

Introduction

The Guarantee of Origin (GO) scheme is an Australian Government-backed certification scheme to authenticate low-emissions products and renewable electricity.

Renewable Electricity Guarantee of Origin (REGO) certificates will provide information on when, where and how renewable electricity was produced, allowing users to make verifiable claims to renewable electricity use.

The *Future Made in Australia (Guarantee of Origin) Act 2024* (*GO Act*) includes provisions to register renewable electricity generation systems, energy storage systems and aggregated systems, and to create certificates associated with renewable electricity that is generated or dispatched from them.

The *Future Made in Australia (Guarantee of Origin) Rules* 2025 will set out the details of the GO scheme and are currently being drafted. This concept paper outlines the policy direction for the rules relating to energy storage systems that have not been included in the current exposure draft (tranche 2) of the rules.

As energy storage systems are a new and technically complex area of renewable electricity certification (electricity dispatched from storage is not currently certified under the RET), this concept paper steps through the intended approach to energy storage systems for REGO in detail. The rules related to energy storage systems are intended to be ready for scheme commencement and an exposure draft of the rules will be released in the third tranche of consultation. The third tranche of consultation will be released ahead of scheme commencement and will also include the Measurement Standard for REGO.

Including energy storage to be eligible to create REGO certificates is an acknowledgement of the increasing importance of storage in energy systems. Energy storage systems are fundamental to Australia's electricity grid and its transition to a low-emission energy future. Energy storage bridges the gap between energy production and consumption by capturing excess electricity when generation exceeds demand and releasing it when needed, smoothing out the variability of renewables and ensuring a steady, reliable power supply for homes, businesses, and industry As energy storage systems don't directly generate renewable electricity, this paper sets out additional requirements and rules to ensure REGO certificates produced from energy storage systems demonstrably represent renewable electricity. Each topic below will discuss the rules that ensure the provision of transparent and trusted information integral to supporting the objectives of the REGO scheme.

Topics

This paper covers the topics relating to the rules for energy storage systems. For each topic, the sections below outline the scope and purpose of the associated rule, relevant sections of the *GO Act*, and an overview of proposed policy and inclusions that will be used in the development of the associated rule.

There are several sections under the *GO Act* related to energy storage systems that enable further information to be prescribed in the rules. This paper will cover the following topics for energy storage systems and the relevant sections of the *GO Act* will be referenced within:

1. Information included in an application - energy storage systems
2. Information included in an application - direct supply relationship

3. Registration requirements - energy storage systems
4. Component guidelines
5. Circumstances where components may be shared
6. Conditions on registration
7. Information included on a 'record' for a facility
8. Notification of events
9. Maximum eligible amount – energy storage systems
10. Direct supply relationship
11. Eligible amount - energy storage systems
12. Required information on a REGO certificate
13. Optional information on a REGO certificate
14. Form and identification of systems
15. Registration of REGO certificates - Relevant considerations
16. Metering arrangements to enable calculation

Exclusions

Treatment of issues specific to hydro as storage are not included in this paper and will be considered separately.

Feedback

A series of technical working groups with industry experts have been held with feedback from these sessions incorporated in this concept paper.

Several topics below have guiding questions on items to prompt feedback. Please note these do not need to limit the topics or items that feedback is provided on.

If you would like to provide feedback on this concept paper, please make a submission in writing to RenewableEnergy@DCCEEW.gov.au. The proposed inclusions on energy storage systems in this paper intend to cover a variety of different storage types and set-ups, the department would value feedback on the application of proposed concepts to different storage types. Please ensure that when providing feedback, the relevant topic or issue is clearly referenced.

The department is also seeking feedback on Exposure Drafts of each of the legislative instruments that will support the GO scheme. These instruments are:

1. Future Made in Australia (Guarantee of Origin) Rules 2025
2. Future Made in Australia (Guarantee of Origin) Methodology Determination 2025
3. Future Made in Australia (Guarantee of Origin Charges) Regulations 2025

Further information on these consultations can be found on the Have Your Say home page.

Background

Energy storage systems

Energy storage systems are one of several types of systems that can participate in the REGO scheme. The intended definition of an energy storage system for REGO has been provided below.

Definition: Energy storage system

A facility that stores electricity for later use is referred to as an **energy storage system**. The facility takes electricity as an input, stores it as some form of energy (e.g. chemical, mechanical, kinetic, thermal, gravitational), and then dispatches it as electricity at a later time.

Energy storage systems do not directly generate electricity, but store electricity generated from other generation systems, which may or may not generate electricity from an eligible renewable energy source.

Hybrid systems

For the purposes of this paper, a hybrid system describes a collocated electricity generation system and energy storage system. These systems may or may not be registered as a hybrid system in the National Electricity Market (NEM) in accordance with the National Electricity Rules (NER). The electricity generation system may be the only source, or one of many sources, supplying electricity to the energy storage system.

It is intended that the electricity generation system and energy storage system of a hybrid system register as separate facilities for REGO. The registration approach for an energy storage system is set out below at figure 1. The relationship between the two systems that form part of a hybrid system is recognised through the 'direct supply' relationship rules (please see topic 10 below).

Energy storage systems in the GO scheme

The key steps for an energy storage system to participate in the REGO scheme can be seen below in **Error! Reference source not found.**. An energy storage system must be registered as a facility before REGO certificates can be created in respect of the facility.

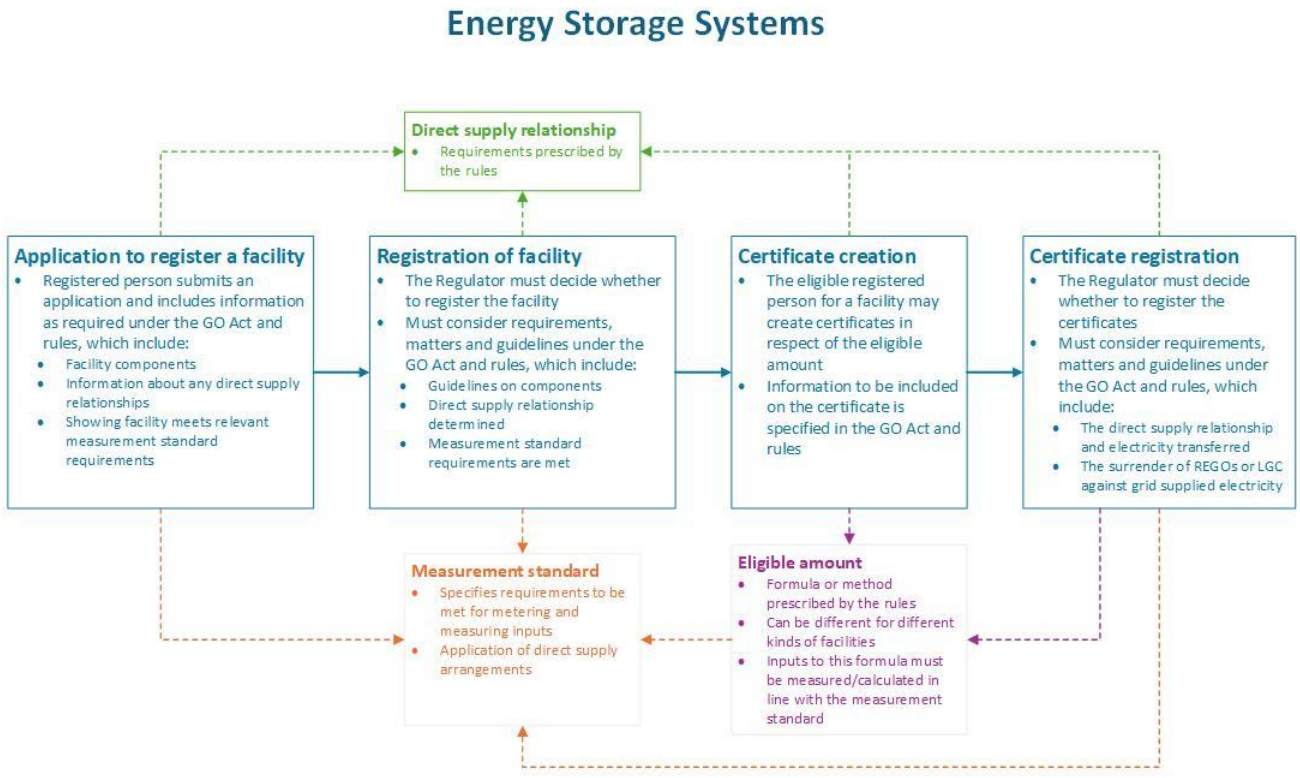


Figure 1 – Energy storage systems: Registration and Certificate

1. Information included in an application – energy storage systems

Purpose

The information that is required to be provided as part of an application to register electricity generation systems, energy storage systems and aggregated systems is set out in subsection 75(3) of the *GO Act*. Section 75 of the *GO Act* also allows for further information to be prescribed by the Rules and that different requirements can be made for different facility types. Section 35 of the draft rules provides further information that must be included in an application to register other facilities including generation systems, energy storage systems and aggregated systems to assist the Regulator in making a decision on whether or not to register an energy storage system.

Further rules specific to energy storage systems are intended to be included for applications (these are detailed below).

Proposed inclusions

Additional information proposed to be included in rules in an application for an energy storage system includes:

- The facility's nameplate storage power in megawatts (MW)
- The facility's nameplate storage capacity in megawatt hours (MWh)
- Type of energy storage system
- All applicable electricity inputs, which may include:
    - Direct supply electricity;
    - Grid supplied electricity;
    - Onsite non eligible supplied electricity.
- Details of the electricity import, energy storage and electricity dispatch process for the facility.
- The rated round-trip efficiency for each energy storage unit, where this may differ between units, at the time of application.
- an electrical single line diagram (ESLD) for the system including:
    - details supporting any relevant information in the application;
    - metering or measurement arrangements demonstrating compliance with the measurement standard.
- Estimated operational life expectancy, in years, of:
    - the facility;
    - key components, if the life expectancy differs to that of the facility (e.g. battery modules are generally expected to have shorter life cycles and may require more regular replacement).

Considerations

The items to be included in the application (listed above) assist in demonstrating that the facility will be able to operate in line with the Act and any prescribed requirements.

Consistency with the types of information requested for other facilities has been maintained where possible. This includes the nameplate storage power and capacity which is informed directly by the components that are considered part of the facility.

However, as energy storage systems don't directly generate renewable electricity, there is additional information that is considered critical to demonstrating eligibility for energy storage systems.

The electricity inputs, operational processes and rated round-trip efficiency are essential to several topics discussed further below.

2. Information included in an application – direct supply relationship

Purpose

If an energy storage system is applying to register as a facility, and it has a direct supply relationship with an electricity generation system, it needs to be determined if the direct supply relationship meets the requirements under the *GO Act* and the rules (see topic 10 below). Paragraph 75(3)(h) of the *GO Act* allows for the rules to prescribe the information to be provided in the application to support the assessment of the application and that requirements will be met.

Proposed inclusions

Additional information proposed to be included in an application for an energy storage facility that has a direct supply relationship includes:

- Name of generation system
- Location of generation system
- Owner of generation system (*may be same as the energy storage facility*)
- If the generation system is an accredited power station and/or registered renewable electricity facility, the accreditation and/or registration code for the generation system*.
- If the generation system intends to be, an accredited power station and/or registered renewable electricity facility, the estimated timeframe to become accredited and/or registered*.
- Evidence that each of the requirements for a direct supply relationship has been met
- An electrical single line diagram (ESLD) showing the relationship, and metering points, between the energy storage and electricity generation systems
- Whether the systems are AC or DC coupled.

**It should be noted that the language used across REGO and RET differs:*

REGO: registered renewable electricity facility that has a registration code.

RET: accredited power station that has an accreditation code.

An electricity generation system could be registered in REGO or RET or both or neither. If the electricity generation system is participating in one of the schemes, the applicable code is an important identifier.

Considerations

It is intended that an electricity generation system and energy storage system would register as separate facilities for REGO. However, a direct supply relationship may exist between an electricity generation system and an energy storage system that will impact the calculation of the eligible amount of electricity for both. Information provided in the application must enable clear identification of the systems involved.

The proposed requirements for inclusion in the application requires that enough information to identify the electricity generation system, without being onerous, is included in an application for the energy storage system.

3. Registration requirements – energy storage systems

Purpose

Section 80 of the *GO Act* sets out the requirements on registration of an energy storage facility with further requirements to be set out in rules, including requirements for identifying an energy storage system and its components.

Proposed inclusions

Proposed additional requirements (under s80(2)(f)) that the energy storage system, and each of its components, must meet include:

- that all components of a facility are:
    - integrated or interrelated, and
    - integral to the operation of the system, import and/or export of electricity, and/or storage of energy.

The proposed matters that the Regulator must have regard to (s80(4)(a)(ii)) when deciding to register an energy storage facility include:

- Whether a suitability event (as defined in section 4 of the draft Rules) has occurred in relation to the applicant.
- If a direct supply relationship exists between a generation system and an energy storage system, whether the direct supply relationship meets the requirements outlined in the rules.
- If the electricity generation system that the energy storage facility has a direct supply relationship with is an accredited power station and/or is registered under REGO, whether the information included about the generation system matches the information the Regulator has under the relevant scheme.

Considerations

The proposed requirements are similar to those that have been drafted for the registration of electricity generation systems but adjusted slightly to be relevant for energy storage systems (see subsections 37(1)-(2) of the draft rules).

It is intended that the additional requirements will cover:

- any component that operates to transform and store electricity within the energy storage system, and transform and dispatch electricity from the energy storage system
- and any infrastructure of the system, including buildings, information technology, instrumentation and controls.

General and specific component guidelines are discussed further in topic 4 below.

Additional requirements have been included for facilities (energy storage systems and electricity generation systems) that have a direct supply relationship, as this impacts:

- The eligible amount for the generator as direct supplied energy, which must be removed from the eligible amount of the electricity generation system to avoid double counting under section 97 of the *GO Act*.
- The required certificate retirements for an energy storage system, which are discussed further in topic 11 below.

4. Component guidelines

Purpose

Subparagraph 80(4)(a)(i) of the *GO Act* allows guidelines to be prescribed by the rules in relation to what components may make up an energy storage system. The Regulator must have regard to these guidelines when registering an energy storage facility.

Proposed inclusions

1. General

1.1 Components are considered part of a facility if they are integral to the operation of the system, and the import and/or export of electricity, and/or storage of energy, regardless of the owner or operator of the components.
1.2 Infrastructure including buildings or stationary infrastructure are included.
1.3 The components of a facility may vary depending on the type of facility.
1.4 These guidelines are not intended to limit the kind of components of an energy storage system that may be taken to be part of a facility for the Act.
1.5 Generally, energy storage systems are likely to include the following components:
    (a) Switchboard or switchroom
    (b) Transformer
    (c) Control system
    (d) Telemetering system
    (e) Protection system
    (f) Metering instrument
    (g) Monitoring instrument
    (h) Instrumentation
    (i) Buildings or stationary infrastructure
    (j) Backup power supply
    (k) Cabling
    (l) Substation
    (m) Switchyard

2. Battery energy storage system

2.1 For a facility that is a battery energy storage system, the components may also include the following:
    (a) Battery modules (consisting of battery cells)
    (b) Framework and housing
    (c) Power conversion system (inverter, converter)
    (d) Thermal management system
    (e) Fire suppression system

3. Compressed Gas Energy Storage System

3.1 For a facility that is a compressed gas (e.g. air or CO2) energy storage system, the components may also include the following:
    (a) Motor
    (b) Generator
    (c) Turbine
    (d) Compressor
    (e) Expander
    (f) Storage system (could be a tank or cavern)
    (g) Condenser (intercooler/aftercooler)
    (h) Recuperator
    (i) Cooling system
    (j) Piping and fittings

4. Thermal Energy Storage System

4.1 For a facility that is a thermal energy storage system, the components may also include the following:
    (a) Turbine
    (b) Motor
    (c) Generator
    (d) Storage medium
    (e) Heating equipment (heater, preheater, reheater)

(f) Heat exchanger
(g) Condenser
(h) Storage/containment system (tank, etc)
(i) Insulation
(j) Thermal management system

5. Kinetic Energy Storage System

5.1 For a facility that is a kinetic energy storage system, the components may also include the following:

(a) Flywheel rotor
(b) Rotor assembly
(c) Motor/generator
(d) Vacuum chamber and pump
(e) Bearings

6. Gravitational Energy Storage Systems

6.1 For a facility that is a gravitational energy storage system, the components may also include the following:

(a) Generator
(b) Shaft/structure
(c) Motors
(d) Pumps
(e) Weight

Considerations

Consistent principles and similar types of information are requested to that requested for electricity generation systems in the draft rules under Schedule 1—Guidelines for determining components of electricity generation system.

The principles in determining the components are that an energy storage system should include components that are integral to the operation of the energy storage system or to the charge, storage and discharge of electricity by the energy storage system.

As the Regulator may refuse to register a facility if a component included in the application should not be included in the facility, there need to be transparent guidelines on what should and shouldn't be included as components of the different energy storage systems. These guidelines are not intended to limit the kind of components of an energy storage system that may be taken to be part of a facility for the Act.

5. Circumstances where components may be shared

Purpose

When registering a facility, it is a requirement that none of the components of the facility are included in an accredited power station or a different registered renewable electricity facility, unless the rules provide circumstances where the requirement doesn't apply and components may be shared between facilities (Subsection 80(7) of the *GO Act*).

Proposed inclusions

Proposed circumstances and components where this requirement does not apply for an energy storage facility includes:

- A component may be shared with an accredited power station or another registered renewable electricity facility if the component is:

- shared between facilities that are co-located; and
- one of the following types of components:
  - a supplementary power supply
  - general components (e.g. those listed in the draft rules under clause 1 of Schedule 1—Guidelines for determining components of electricity generation system)
  - transmission and distribution infrastructure.
  - in the case of DC coupled storage and generators, the power conversion system (inverter, converter)

Considerations

The proposed inclusions are very similar to those drafted for electricity generation systems in subsections 37(4)-(6) of the draft rules.

This is particularly important for hybrid facilities, where it's likely some components will be shared, but generation and storage facilities are required to be separately registered.

In most cases, the primary components directly related to generating or storing electricity should not be shared. There is an exception for DC coupled storage and generators where inverters can be considered a shared component as it is required by both systems for the conversion of electricity. Inverters are not allowed to be shared components in all other cases as they are generally considered primary components.

6. Conditions on registration

Purpose

Subsection 80(5) of the *GO Act* allows the rules to specify the kinds of conditions that may be imposed on the registration of an energy storage facility. The types of conditions imposed may include additional requirements for eligible registered persons, for example in terms of reporting.

Proposed inclusions

The proposed types of conditions include:

- A condition requiring reporting in relation to:
  - operation of the facility, or
  - any other aspect of compliance with the Act.
- A condition requiring the use of a stated component or process.

Considerations

It is considered appropriate that the types of conditions that can be imposed on a facility are the same for both electricity generation systems and energy storage systems. The proposed conditions are therefore the same as what is already in subsection 37(3) of the draft rules for electricity generation systems.

7. Information included on a 'record' for a facility

Purpose

Section 84 of the *GO Act* sets out that if a facility is registered, a record must be created for the facility which includes each component and any other specified information. Topic 5 above provides guidelines for the components that may make up an energy storage facility which are required to be on the record (see paragraph 84(1)(a) of the *GO Act*). Section 42 of the draft rules prescribes

information that must be included in a record for all facility types. The prescribed information within a record may be different for different facility types. This section of the rules will consider any additional information to be included on a record for energy storage facilities.

Proposed inclusions

Additional information proposed to be included in a record for an energy storage facility includes:

- The facility's nameplate storage power in megawatts (MW)
- The facility's nameplate storage capacity in megawatt hours (MWh)
- Type of energy storage system
- Electricity inputs

Additional information to be included in a record for a facility (that is an energy storage system, electricity generation system, or accredited power station) that has a direct supply relationship:

- details of the other facility that the facility has a direct supply relationship with (name and location).

Considerations

The type of energy storage system and electricity inputs have been included, as these may be amended or changed as part of a variation to a facility and are important in determining eligibility.

Where facilities have a direct supply relationship, it is important for all the facilities involved. If this relationship changes for one facility, it may impact the other.

8. Notification of events

Purpose

Section 85 of the *GO Act* requires that the eligible registered person for a facility must notify the Regulator if a specified event occurs. These events relate to any material changes to the facility. Subsection 85(2) sets out specified events and allows for other events to be prescribed by the rules. Section 43 of the draft rules prescribes events for all facility types. This section of the rules is considering any additional events to be included that relate to an energy storage facility.

Proposed Inclusions

Additional specified events proposed to be included that relate to an energy storage facility includes:

- the facility has added or removed a connection to import electricity.

Considerations

Material changes would include things that would materially affect the ability of the Regulator to be certain of the accuracy of information pertaining to the creation of that certificate, or the ongoing eligibility of the facility under the scheme.

For energy storage systems, the sources of electricity imported into the system are crucial in determining the number of REGO or LGC certificates to be retired to register the energy storage certificates. The Regulator must therefore have up to date records of all energy imports to be satisfied of the accuracy of the certificates – that certificates being registered represent 1MWh of eligible renewable electricity.

9. Maximum eligible amount – energy storage systems

Purpose

Key to creation of certificates in respect of renewable electricity is ensuring that the certificates are representative of eligible renewable electricity only. Under REGO, this outcome is reached through determining an *eligible amount* of electricity from electricity used, generated or dispatched by the facility. The method for doing this will be specified in rules.

- Subsection 91(4) of the *GO Act* states that the rules can prescribe a method or formula used to determine the eligible amount of electricity for a facility and a time period.
- Subsection 91(5) of the *GO Act* specifies that different formulas or methods can be made in relation to different kinds of facilities.

A method for determining the eligible amount for electricity generation systems has been prescribed in section 46 of the draft rules. The below approach sets out a method for determining the eligible amount for energy storage systems.

Proposed method and formula

The method proposed to determine the eligible amount for energy storage facilities is intended to be accurate, flexible and consistent. Calculating the maximum eligible amount for an energy storage facility follows a similar approach to that being proposed for calculating the eligible amount for facilities that are electricity generation systems. However, as energy storage facilities don't generate renewable electricity, there is an extra step involved in demonstrating that electricity from an energy storage facility is renewable electricity (discussed in topics 10 and 11 below). The broad steps in determining the maximum eligible amount are:

1. Measure and sum the *total electricity dispatched* from the facility in the time period.
2. Calculate and subtract any *defined auxiliary losses* relevant to the electricity dispatched in the time period.
3. Calculate and subtract *transmission losses*, if the facility has a marginal loss factor (MLF).

Please see further explanation of key terms below.

Total electricity dispatched

Total electricity dispatched means all the electricity dispatched from the energy storage facility in the relevant time period, as measured at all the energy storage system terminals.

Ideally this would be measured at the connection point meter, but if the connection point meter is shared with an electricity generation facility or there are onsite loads, metering would be required at a different point to accurately measure the total amount of electricity dispatched. Metering requirements will be contained in the measurement standard.

Defined auxiliary losses

It is proposed that ***auxiliary losses for energy storage systems*** be defined as the amount of electricity used to operate and maintain the facility, in relation to the electricity dispatched in the time period. Relevant auxiliary losses could be thermal management systems, heating or cooling systems, pumps, etc, but would not include any electricity used for network control ancillary services.

Unlike electricity generation systems, the electricity imported to an energy storage system is not just electricity used for auxiliary loads. The difference between the electricity imported and dispatched from an energy storage system are the energy storage system's total electricity losses. These losses

could be from auxiliary loads, conversion processes or self-discharge. The losses due to energy conversion and self-discharge will not be considered as auxiliary losses - this is discussed in topic 11 below.

To maintain consistency with the treatment of auxiliary losses for generators, consideration needs to be given for auxiliary losses that occur outside the time periods of dispatch, but relate to the electricity dispatched, particularly when considering hourly time periods. This is done through the application of an auxiliary factor.

Auxiliary factor

The method to account for this is the same as that proposed for electricity generation systems, which is to calculate and use an *auxiliary factor*. This would take the total auxiliary losses over a time period (e.g. over the month if creating hourly certificates) and then apportion the losses over the total electricity dispatched in that same time period. This would provide the auxiliary factor, which is auxiliary losses per MWh of electricity dispatched.

$$Auxiliary\ Factor\ (AF) = \frac{AUX}{TG}$$

AUX = auxiliary loss (MWh) for the facility for the month (if hourly) or matching time period

TG = total electricity dispatched (MWh) by the facility for the month (if hourly) or matching time period

When determining the maximum eligible amount for a time period, the auxiliary losses for that time period would be calculated by multiplying the auxiliary factor by the electricity dispatched in that time period.

Transmission losses

Transmission losses would be calculated for facilities that have an MLF published by AEMO to allow for the amount of electricity losses in transmission networks.

Transmission losses would only be calculated for electricity being dispatched into the transmission network by the facility and measured at the point determined under the NER or by an authority of the relevant State or Territory.

$$Transmission\ Losses\ (TL_t) = DLEG_t \times (1 - MLF)$$

MLF = Marginal loss factor as in force at the time period

$DLEG_t$ = the amount of electricity transmitted for the time period

Maximum eligible amount formula

Pulling this all together, the proposed formula to determine the maximum eligible amount for a time period for an energy storage facility is:

Maximum eligible amount for the time period, $MAXEA_t = TLEG_t - (TLEG_t \times AF) - TL_t$

Simplified: $$MAXEA_t = [TLEG_t \times (1 - AF)] - TL_t$$

$TLEG_t$ = the amount of electricity dispatched by the facility for the time period

AF = auxiliary factor (ratio of auxiliary losses to electricity dispatched, for the month (if hourly) or matching time period)

TL_t = Transmission losses (if relevant)

FSL

FSL is any electricity generated using anything than an eligible renewable energy source. For example using fossil fuels.

This term is not used in the eligible amount formula for energy storage systems, as the eligible amount relates to electricity dispatched, not generated or imported. Any electricity can be imported to charge the energy storage system, but the determination of whether this is renewable electricity is discussed further in topics 10 and 11 below.

Example:

REGO certificates are only eligible to be created for the net electricity sent from the facility that meets a demand for electricity not associated with a storage or generation facility and adjusted for transmission losses where applicable. This represents the "maximum" eligible amount. To find this value, the following key steps are envisioned:

Measure and sum the total electricity dispatched from the facility in the time period: For example, an energy storage facility dispatches 100MWh in a month. 20MWh is dispatched to an eligible onsite load and 80MWh to the network.

Measure and sum any defined auxiliary losses relevant to the facility in the time period. The facility uses 5 MWh in a month maintaining and operating the battery. This includes electricity used in operations and control as well as by cooling systems for the battery.
Note: The efficiency losses associated with storing electricity are not considered an auxiliary loss and are accounted for later.

Calculate the auxiliary factor relevant to the electricity dispatched in the time period. The Auxiliary Factor (AF) for the facility is calculated to be 5% (because 5 MWh ÷ 100 MWh = 0.05).
Note: The auxiliary factor is crucial for creating hourly timestamped REGOs to accurately attribute losses to a period of generation. The below is a simple example for creating monthly certificates.

Calculate transmission losses, if the facility has a marginal loss factor (MLF). The facility has an MLF determined by AEMO of 0.95. The Transmission Losses (TL) for the facility are only calculated on the electricity sent to the network and come to 4 MWh (because 80 MWh × (1 – 0.95) = 4 MWh). There are no transmission losses associated with the 20MWh dispatched to the eligible onsite load.

Calculate the maximum eligible amount by deducting auxiliaries and transmission losses from the total dispatched electricity. The facility has a maximum eligible amount of 91 MWh (because 100 MWh × (1 – 0.05) – 4 MWh = 91 MWh).

Note: Because energy storage facilities don't generate renewable electricity, the actual eligible amount that certificates can be created in respect of, must consider the eligible renewable electricity that has been used in charging the facility. This and related concepts are covered in topics 10 and 11 below.

Considerations

There are a number of considerations that have informed the proposed formula/method.

- Flexibility for the method to apply over the different time periods and, where possible, for different types of energy storage facilities*.

    - The method needs to be flexible enough to work for smaller and larger periods of time. Time periods will be an hour, day, calendar month and calendar year.
    - Ideally the proposed methods will be fit for purpose for both existing and future technologies*.
- Accuracy of the eligibility calculation. It's essential that the calculation of the maximum eligible amount accurately reflects the usable electricity that meets a demand.
- Consistency between different facility types, in terms of accounting for auxiliary losses and having the maximum eligible amount based on net electricity rather than gross electricity.

**It should be noted that issues specific to pumped hydro systems are still under development.*

Questions

- Losses associated with network support and control ancillary services do not contribute to auxiliary losses or efficiency factor (discussed in topic 11). Is this reasonable and are there any other cases where losses shouldn't be considered for energy storage systems? Please indicate why this would be the case.

10. Direct supply relationship

Purpose

The *GO Act* (at section 71) defines a direct supply relationship at a high level and enables rules to be made prescribing further requirements.

An electricity generation system and energy storage system will have a *direct supply relationship* for the purposes of the *GO Act*, if:

- electricity is transferred to the energy storage system directly from the electricity generation system, and
- the requirements in the rules are met for the following:
    - energy storage system,
    - electricity generation system, and
    - transfer.

This section of the paper will set out the requirements that will be included in rules that are intended to be met for the energy storage system, the electricity generation system, and the transfer, in order for the systems to be classified as having a *direct supply relationship*.

Whether a direct supply relationship exists will be determined at registration of the energy storage system based on information provided in the application.

If the requirements that apply to a direct supply relationship are met, this enables the energy storage system to utilise rules related to direct supply in the calculation of eligible amount for the energy storage system.

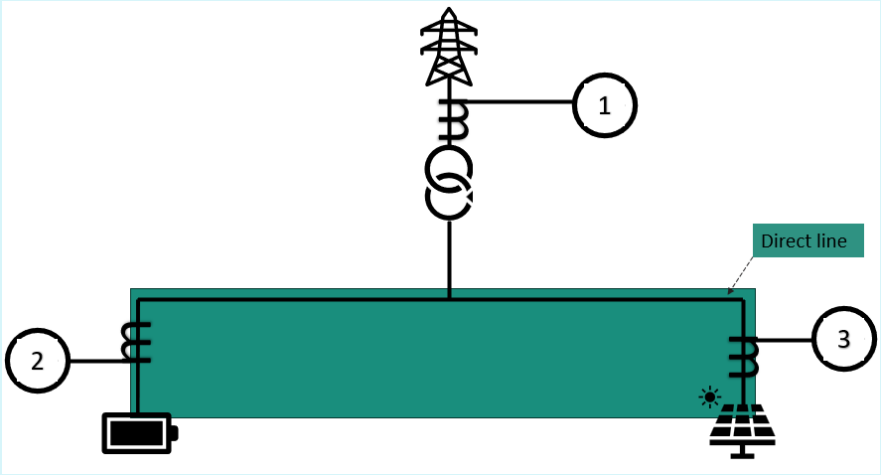
Proposed Inclusions

Requirements to be met for an energy storage system and an electricity generation system to have a *direct supply relationship are*:

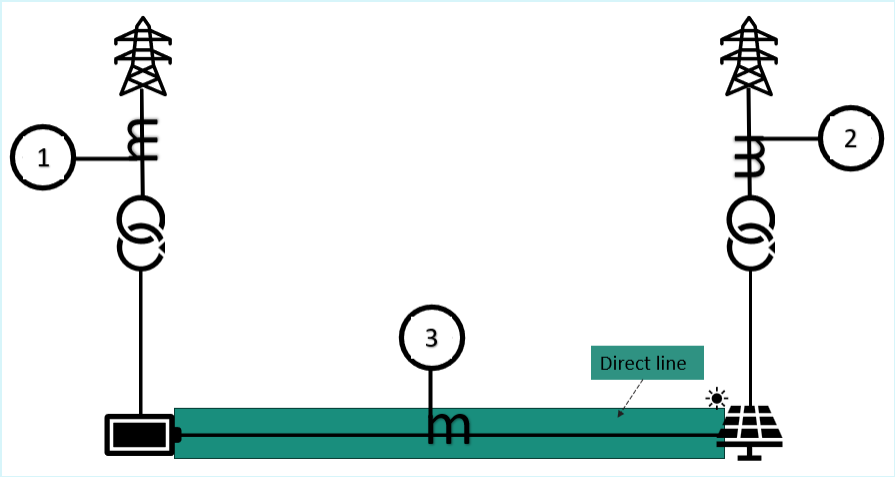
- For the energy storage system:
    - All electrical inputs to the energy storage system, including from other renewable or non-renewable electricity generation systems and/or external electricity sources including the grid, must be appropriately and separately metered as per the measurement standard.

- For the electricity generation system:
    - Supplies eligible renewable electricity to the energy storage system. *Note: the electricity generation system doesn't need to exclusively supply eligible renewable electricity.*
        - The requirement that the electricity generation system supplies eligible renewable electricity is demonstrated if the system is a registered electricity generation facility or an accredited power station.
        - If the electricity generation system is not registered under the *GO Act* or the *Renewable Energy (Electricity) Act 2000* (*REE Act*), the system must use an eligible renewable energy source and meet any energy source specific requirements under the *GO Act* and GO Rules.
    - Any eligible renewable and non-eligible electricity supplied from the electricity generation system to the energy storage system can be measured or calculated separately, as per the measurement standard.
    - Is operated in accordance with any relevant Commonwealth, State, Territory or local government planning and approval requirements.
        - This requirement is met if the system is a registered electricity generation facility or an accredited power station.
        - If the electricity generation system is not already registered under the *GO Act* and the rules, the owner must provide a statement or declaration that the system is operated in accordance with any relevant Commonwealth, State, Territory or local government planning and approval requirements.
- For the electricity transfer:
- The electricity transferred from the electricity generation system to the energy storage system must be identifiable and measurable.
    - The transfer occurs through a direct line between the energy storage system and electricity generation system. A direct line is defined as:
        - behind a connection point meter (i.e. the electricity doesn't pass through a shared grid/network).
        - only feeding unmetered electricity to the auxiliary loads of the energy storage system and electricity generation system.
        - only feeding metered electricity to loads behind the connection point meter.
    - Metering at all relevant points, as per the measurement standard, which allows for the demonstration and measurement of the electricity transfer.

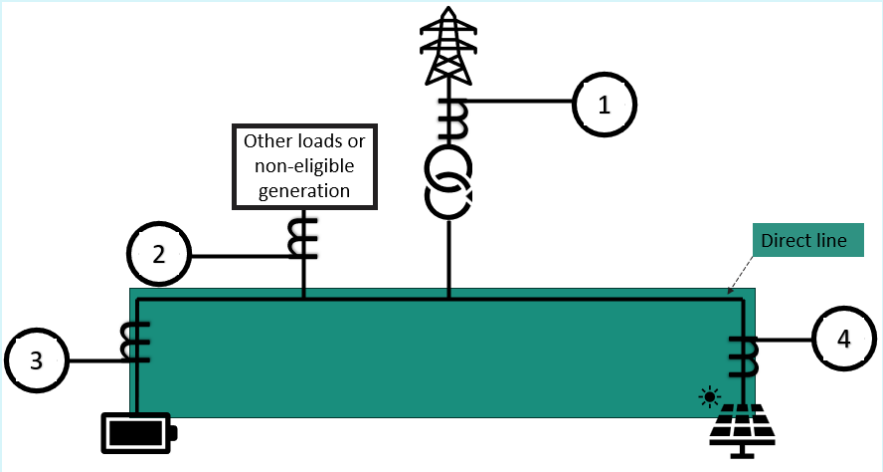
Example: simple hybrid, direct supply relationship with direct line highlighted.



Example: dual connection point, direct supply relationship with direct line highlighted.



Example: additional connections, direct supply relationship with direct line highlighted.



Considerations

A key consideration in developing the requirements for the direct supply relationship was whether the direct line between the electricity generator and the energy storage system needed to be an exclusive line (i.e. have nothing else connected). The proposed approach does not require this as long as the amount of electricity from the electricity generation system going into the energy storage system can be determined. Any other electricity inputs into the energy storage system must also be identifiable and measurable. What can, and what can't be, connected to the direct line (as shown above in the requirements for the electricity transfer) is also required.

The requirements should be flexible enough to work for differing setups. However if the requirements for a direct supply relationship are not met an energy storage system would still be able to register as a facility and create certificates – it will just be subject to different rules.

The requirements shouldn't conflict with the updated NEM rules regarding hybrids.

The electricity generation system that has a direct supply relationship with an energy storage system, does not have to be registered under the GO scheme or accredited under the *REE Act*.

The requirements for an electricity generation system are designed to ensure it produces **eligible** renewable electricity, operates appropriately, is safe, and is properly electrically connected. If the system is registered under the *GO Act* or accredited under the *REE Act*, these criteria are automatically considered satisfied. However, for systems not registered or accredited under these schemes, the owner must provide separate evidence to demonstrate compliance with these requirements. The application of the direct supply relationship to facilities with legacy baselines will be further considered. Any rules applying to legacy baselines will need to ensure that the power station/facility with the baseline is acting in accordance with any baseline requirements.

Questions

- What are your views on the requirements for a direct line and what can and can't be connected to this line?
- Are there any additional considerations if the hybrid project is registered as such in the NEM?

11. Eligible amount - energy storage systems

Purpose

REGO certificates can be created for the maximum eligible amount worked out in accordance with the rules provided it is demonstrably renewable electricity. Electricity can be demonstrated as being renewable for the purposes of creating REGOs from an Energy Storage System through electricity being directly supplied renewable electricity (meeting the applicable requirements set out in the rules), and/or through surrendering LGCs or retiring REGOs against other electricity imported and stored by the facility.

Eligible amount – direct supply only

Different facilities will demonstrate that they are producing renewable electricity depending on their configuration and where their electricity is sourced from. If an energy storage facility's only electricity input is directly supplied renewable electricity being imported into the facility, the facility has a simplified process for demonstrating all electricity imported is renewable, and is not required to surrender LGCs or retire REGOs.

Proposed inclusions

Energy storage certificates can be registered if there is a direct supply relationship between an energy storage system and an electricity generation system that meet the following proposed requirements:

- The direct supply relationship must meet all the requirements specified in the *GO Act* and the rules.
- The only electricity input to the energy storage facility is from the electricity generation system/s that have a direct supply relationship with the facility.
- The electricity generation system generates eligible renewable electricity only.

Eligible amount – other

Many energy storage systems will be importing some or all electricity from sources other than an electricity generation system which is wholly and directly supplying renewable electricity. For these energy storage systems, the eligible registered person must demonstrate that all electricity imported, that relates to the electricity dispatched and is represented by the certificates, is renewable. This can be done by surrendering LGCs, retiring REGOs and/or directly supplied electricity equal to a number determined in the rules, which represents the amount of electricity imported. It is proposed that an efficiency factor will be used to identify the number of certificates that will need to be surrendered or retired. The efficiency factor is applied to the electricity dispatched in the time period , to account for losses and determine the amount of electricity imported.

The proposed formula is:

$$Required\ Renewable\ Electricity_t = \frac{TLEG_t}{EF} = Certs_{LGCs} + Certs_{REGOs} + DSE_t$$

$TLEG_t$ = the amount of electricity dispatched by the facility for the time period.

EF = efficiency factor, as calculated for the facility. *Outlined further below.*

$Certs_{LGCs}$ = number of large-scale generation certificates (LGCs) surrendered for the purposes of the application.

$Certs_{REGOs}$ = number of megawatt hours of renewable electricity that is represented by REGO certificates retired for the purposes of the application.

DSE_t = a number of megawatt hours that relates to the amount of directly supplied renewable electricity for the time-period. *Outlined further below.*

This can be expressed to determine the number of certificates, either LGCs or REGOs, which need to be retired.

$$Certificates\ to\ retire_t = Certs_{LGCs} + Certs_{REGOs} = \frac{TLEG_t}{EF} - DSE_t$$

If the number reached by the formula is not a whole number, the number of certificates to retire in order to register the energy storage certificates for a time period must be rounded up to the nearest whole number (noting REGO certificates only currently represent 1 MWh).

Efficiency factor

For simplicity, this is proposed to be determined as the round-trip efficiency of the system over a *specified period of time*.

Specified period of time = the same period of time for which the AUX factor was calculated (for the month (if hourly) or matching time period)

The formula for calculating the efficiency factor is:

$$EF_s = \frac{ElectricityOut_s}{(ElectricityIn_s - EX_s - AUX_s)}$$

Electricity$_{in}$ = amount of electricity, in MWh, imported to the energy storage system over the *specified period of time (s)*.

Electricity$_{out}$ = amount of electricity, in MWh, exported by the energy storage system over the *specified period of time (s)*.

EX$_s$ = amount of electricity that is permitted to be excluded over the *specified period of time (**s**).*

AUX$_s$ = The sum of any *AUX* (defined auxiliary losses) used in the calculation of maximum eligible amount over the *specified period of time (**s**)* that is measured/metered on the facility side of the meter used for *ElectricityIn*.

To reduce the complexity and burden, it is proposed that the efficiency factor is calculated and applied for the same amount of time as the *specified period of time*.

Directly supplied electricity (DSE)

The rules can prescribe a method to work out the number of megawatt hours this term represents, in relation to the amount of directly supplied electricity.

Similarly to auxiliaries, the amount of renewable electricity directly supplied to the energy storage energy storage system is unlikely to line up with the time periods the energy storage certificates represent, particularly for hourly certificates.

As such, it is proposed that renewable electricity that is directly supplied, is accurately measured/metered as it is imported to the energy storage system but can then be drawn upon as wanted for the certificates being registered in each time period. An additional requirement would be put on the directly supplied renewable electricity, that would only allow for it to be used within a specified amount of time (24 months) after it has been recorded as imported to the energy storage facility. This lines up with the proposed retirement limit for REGO certificates.

This option would allow more choice and flexibility and enable the facility to use the combination of certificates and directly supplied electricity that best suited the facility's or company's needs at each point in time.

Eligible amount formula

Electricity from an energy storage facility must be demonstrably renewable electricity to determine the actual eligible amount for an energy storage facility.

$Demonstrated\ Renewable\ Electricity_t$ = Surrendered LGCs$_t$ + Retired REGOs$_t$ + DSE$_t$

Where: Demonstrated Renewable Electricity ≤ Required Renewable Electricity. This is because maximum Eligible Amount for a time period can't be exceeded.

MAXEA$_t$ = maximum eligible amount for the time-period calculated as per topic 9.

Pulling this all together, the proposed formula to determine the eligible amount for a time period for an energy storage facility is:

Eligible amount for the time period, $EA_t = MAXEA_t \times (\frac{Demonstrated\ Renewable\ Electricity_t}{Required\ Renewable\ Electricity_t})$

The eligible registered person for a registered energy storage facility may create REGO certificates in respect of the eligible amount for the facility and the time period.

Example:

To prove that electricity exported from a storage system is 100% renewable, the operator must show that the energy used to charge the storage system came from renewable sources. This is done through demonstrating eligible directly supplied renewable power or by retiring or surrendering renewable energy certificates (REGOs or LGCs respectively) equal to the total renewable energy input, which accounts for energy losses during storage. To do this the following key steps are envisioned:

Calculate Efficiency Factor: No storage system is 100% efficient. For example, if you charge a battery with 100 MWh of electricity, you might only get 90 MWh back out due to losses. The efficiency factor (EF) would be 90% in this case (because 90 MWh ÷ 100 MWh = 0.9) and you would need to prove more renewable input than the electricity you export.

Note: The efficiency factor is crucial for creating hourly timestamped REGOs to accurately attribute the facility's operations to a period of generation. The below is a simple example for creating monthly certificates.

Determine Renewable Input Required: If you export 90 MWh from storage, but your system is 90% efficient, you actually needed 100 MWh of renewable electricity to charge it (because 9 MWh ÷ 0.9 = 10 MWh). This 100 MWh is the Required Renewable Electricity for your exported energy.

Prove Renewable Input: You can prove this renewable input in three ways:

1) Retire or surrender REGO/LGC certificates: Use certificates representing renewable energy to claim renewable electricity use from the grid.
2) Directly Supplied Renewable Electricity (DSE): If all charging came directly from an eligible renewable energy source, no certificate retirement is required.
3) Combination: Use a mix of certificates and DSE.

For Example: If you used 60 MWh of directly supplied solar power (DSE) to charge the battery, you only need to retire certificates for 40 MWh (100 MWh total required – 60 MWh DSE = 40 MWh).

Certificates and DSE can be used within 24 months of when the renewable electricity was dispatched. This gives operators time to balance their inputs and outputs.

Considerations

Energy storage facilities must demonstrate that all electricity imported, that relates to the electricity dispatched and represented by the certificates they intend to create, is renewable.

To determine the amount of electricity imported, an efficiency factor is applied to the megawatt hours of certificates being registered, which will account for losses.

To ensure auxiliaries aren't double counted, any electricity that has been imported and been accounted for as AUX when calculating the eligible amount, will be subtracted from the imported electricity in the EF calculation.

It is proposed that the efficiency factor generally be calculated and apply over the same month that a certificate claim is occurring in as this would be most representative and would be the same time period as the aux factor calculation.

Questions

- Are there any definitions or terms that need to be changed or further clarified?
- Can you see any issues with the eligible amount calculation for some or all types of energy storage systems where:
    - the proposed method will not work?
    - Alternative measurement approaches may be needed? Please propose an approach if one is needed.
    - storage inputs may include those other than electrical?
- Do you think 24 months would be a reasonable amount of time to use the 'banked' directly supplied electricity?

12. Required information on a REGO certificate for energy storage systems

Purpose

Section 94 of the *GO Act* sets out the information that must appear on all certificates. Paragraph 94(1)(j) allows for required information to be prescribed through rules. Section 48 of the draft rules has prescribed information that must be stated on certificates for all facility types. However, as different requirements can be made for different facility types, further information that is required to be recorded on REGO certificates created by energy storage systems will be included.

Proposed inclusions

The additional information proposed to be included on REGO certificates created by energy storage facilities are:

- Type of energy storage system (as specified at registration), which may include:
    - Battery
    - Compressed gas
    - Thermal
    - Kinetic
    - Gravitational
- A list of all applicable energy inputs (as specified at registration), which may include:
    - Direct supply electricity
    - Grid supplied electricity
    - Onsite non eligible supplied electricity

Considerations

The information on certificates must be accurate and give the market sufficient information to enable appropriate valuation. It is intended to be granular enough to describe and identify the electricity the certificate represents.

Having additional information prescribed in the Rules allows a level of flexibility so that requirements may be refined over time, or new information added to certificates as market demand for certain types of information further evolves.

Questions

- Is there any additional required information that would be useful for either:
    - Enabling appropriate market valuation
    - Identifying the electricity the certificate represents

13. Optional information on a REGO certificate

Purpose

Subsection 94(6) of the *GO Act* allows the Rules to prescribe optional information that may be included on certificates. This allows for different optional information to be prescribed for different facility types. This section of the rules will define what information can be optionally included on REGO certificates created by energy storage systems.

Proposed inclusions

The optional information proposed for REGO certificates created by energy storage facilities are:

- Eligible renewable energy sources from:
    - the associated retired or surrendered certificates, and/or
    - the directly supplied eligible renewable electricity (DSE).

Considerations

The inclusion of this information will not be mandatory and is intended to provide information beyond emissions data to inform values-based decisions.

As energy storage systems don't generate renewable electricity, it may be useful market information to determine the renewable energy fuel sources they represent.

Questions

- Is there any additional optional information that would be useful to help inform values-based decisions?
- Should this proposed optional information be made mandatory?

14. Form and identification of systems

Purpose

Section 95 of the *GO Act* sets out the required form and identifying information a REGO certificate must include and allows for other identifying information to be prescribed by the Rules.

Considerations

There is no proposed additional identifying information. The information required under section 95 the *GO Act*, and the information to be prescribed by the rules discussed in topics 12 and 13 above, should sufficiently enable identification of REGO certificates.

15. Registration of REGO certificates - Relevant considerations

Purpose

Subsection 104(7) of the *GO Act* sets out matters that the Regulator must have regard to in deciding whether to register certificates including any prescribed by the Rules. Subsection 50(2) of the draft rules already prescribes matters the Regulator must have regard to for all facility types. Different matters can be prescribed for different facility types. This section of the rules will define the

information that the regulator must have regard to when deciding to register REGO certificates for energy storage systems.

Proposed inclusions

Proposed matters the Regulator must consider when deciding whether to register REGO certificates for energy storage facilities:

- whether the certificates being surrendered or retired for the purposes of the application meet all other requirements to surrender or retire those certificates.

Considerations

It is important to ensure electricity from an energy storage system must be demonstrably renewable electricity in order to be certified under REGO. This clause works with other relevant clauses to prevent the certification of electricity dispatched from energy storage systems that is not considered renewable electricity in accordance with the *GO Act*.

16. Metering arrangements to enable calculation

Purpose

Section 73 of the *GO Act* states the Minister may, by legislative instrument, prescribe requirements that apply to a facility. This instrument is to be known as a *measurement standard* and may relate to:

- Metering, or otherwise measuring, electricity that is generated, stored, consumed, lost or dispatched by the facility or a component of the facility.
- Measuring an energy source for the facility or a component of the facility.
- Measuring an input (other than an energy source) into the facility or a component of the facility.

The measurement standard will include general metering requirements for all facility types. Different requirements can be prescribed for different facility types. The measurement standard will define the additional metering requirements for energy storage systems.

Proposed inclusions

There will be additional metering points, and measurement requirements, for energy storage systems to enable the calculation of the formulas discussed in topics 9 and 11 of this paper, including:

- Total electricity imported and exported from the energy storage system (to calculate the efficiency factor), ideally as close to the energy storage system terminals as possible.
- Electricity imported to the energy storage facility from any electricity generation systems and/or external electricity sources, including the grid.

Considerations

The accurate measurement and calculation of electricity is integral to ensuring that each certificate accurately represents a whole megawatt hour of renewable electricity. Electricity metering installations must allow for the accurate calculation of all relevant and material inputs in the eligible amount and certificate registration methods and calculations.

To ensure accurate, transparent calculation of the eligible amount, appropriate metering must be in place at locations which measure electricity flows for each of the terms in the methods and calculations.

The measurement standard will reference the National Electricity Rules (NER), particularly parts of chapter 7, in relation to accuracy requirements based on the energy flows the meters will measure.

Questions

- Are there any circumstances where metering at all proposed points wouldn't be obtainable?
    - If so, are there any alternative methods that should be considered that would still meet accuracy requirements e.g. metering all points but one and determining values by exclusion?