Information Document
Energy Storage Guide
ID #2020-013

Information documents are not authoritative. Information documents are for information purposes only and are intended to provide guidance. In the event of any discrepancy between an information document and any authoritative document[1] in effect, the authoritative document governs.

1 Purpose

The purpose of this information document is to provide guidance to market participants regarding which information documents have been amended or developed to include information on energy storage facilities and how those amendments and developments relate to the associated authoritative documents. In addition, this information document contains information regarding energy storage configurations and terminology used throughout the information document amendments.

This information document does not contain references to all ISO authoritative documents applicable to energy storage facilities. It is the obligation of all legal owners, operators, market participants and pool participants to ensure they understand and comply with all authoritative document provisions that are applicable to their facilities.

1.1 ISO rules related documents

This information document relates to the following documents:

- Information Document #2009-003R, Acceptable Operational Reasons, which relates to:
  - Section 203.1 of the ISO rules, *Offers and Bids for Energy* (“Section 203.1”);
  - Section 203.3 of the ISO rules, *Energy Restatements* (“Section 203.3”);
  - Section 203.4 of the ISO rules, *Delivery Requirements for Energy* (“Section 203.4”);
  - Section 203.5 of the ISO rules, *Consumption Requirements for Bids* (“Section 203.5”); and
  - Section 203.6 of the ISO rules, *Available Transfer Capability and Transfer Path Management*.
- Information Document #2011-002R, *Power Pool Settlement Guide*, which relates to Section 103.4 of the ISO rules, *Power Pool Financial Settlement*;
- Information Document #2012-008R, *Energy Offers and Bids*, which relates to Section 203.1;
- Information Document #2012-005R, *Dispatches*, which relates to:
  - Section 201.7 of the ISO rules, *Dispatches*;
  - Section 203.2 of the ISO rules, *Issuing Dispatches for Energy*; and
  - Section 203.4; of the ISO Rules, *Delivery Requirements for Energy.*
- Information Document #2013-005R, *Operating Reserves*, which relates to:
  - Section 205.1 of the ISO rules, *Offers for Operating Reserves*;
  - Section 205.2 of the ISO rules, *Issuing Dispatches for Operating Reserve*;
  - Section 205.3 of the ISO rules, *Restatements for Operating Reserve*;

[1] “Authoritative documents” is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities Act* and associated regulations, and that contain binding legal requirements for either market participants or the AESO, or both. Authoritative documents include: the ISO rules, the reliability standards, and the ISO tariff.

- Section 205.4 of the ISO rules, *Regulating Reserve Technical Requirements and Performance Standards*;
- Section 205.5 of the ISO rules, *Spinning Reserve Technical Requirements and Performance Standards*; and
- Section 205.6 of the ISO rules, *Supplemental Reserve Technical Requirements and Performance Standards*.

- Information Document #2012-009R, *Restatements*, which relates to Section 203.3;
- Information Document #2013-003R, *Outages*, which relates to:
  - Section 306.3 of the ISO rules, *Load Planned Outage Reporting*; and
  - Section 306.5 of the ISO rules, *Source Asset Outage Reporting and Coordination*; and
- Information Document #2020-003R, *Performance Criteria for Energy Storage*, which relates to Section 505.2 of the ISO rules, *Performance Criteria for Refund of Generating Unit Owner's Contribution*.

1.2 Reliability Standard Related Documents

Reliability standards and associated information documents that place requirements on aggregated facilities. See section 4 below for further information.

1.3 Dispatchable Asset classifications

The ISO rules classify dispatchable assets as either:

1) controllable;
2) non-controllable; or
3) partially controllable

For further information on these classifications see the CADG and Information Document #2012-005R, *Dispatches.*

2 Stand-Alone Energy Storage Site Configuration

The AESO considers a stand-alone energy storage site to be a site with an energy storage facility and no other generation facility.

The AESO will assign a pool participant with a stand-alone energy storage resource participating in the energy market and market settlement the following:

a) a source asset to which the energy out-flows from the site are measured and dispatched; and

b) a sink asset to which any in-flows to the site are measured and dispatched (if applicable) in relation to that facility.

The attributes of each asset will vary based on the size, type, and capabilities of the underlying resource.

3 Co-located Technologies Source Asset Configurations

A co-located technologies site is a site with two different energy supply resource technologies on it, where all resources share a common connection to the Alberta Interconnected Electric System. This subsection focuses specifically on sites with an energy storage resource co-located with at least one other generating unit or aggregated facility that is not an energy storage resource.

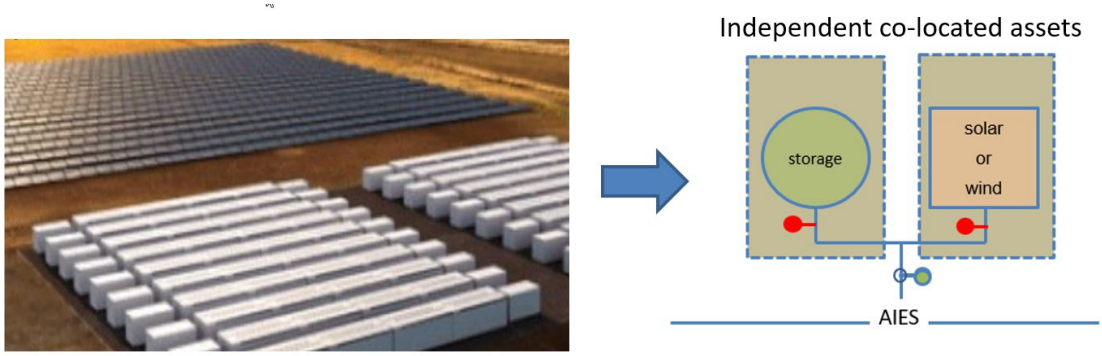
There are two source asset configuration options available to a pool participant with a co-located technologies site. The choice is driven by the electrical configuration of the resources on the site.

The configuration of the asset will determine the method by which the AESO will calculate the availability assessment used to determine the refund of GUOC, as discussed in Information Document #2020-003, *Performance Criteria for Energy Storage*.

Option 1: Choose to offer each on-site resource as separate registered source assets

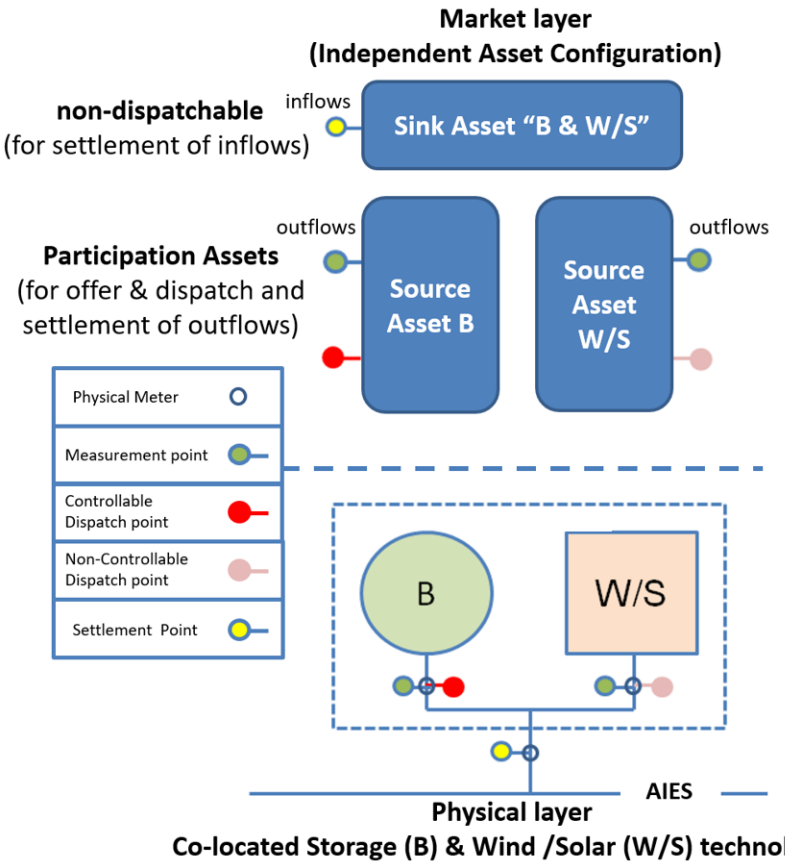
If the configuration permits independent measurements of the two technologies, the AESO recommends the pool participant operate the energy storage facility as a separate and distinct source asset from the on-site generating facilities.

Figure 1 – Example of co-located technologies operating as independent assets:



An independent source asset configuration allows each technology to participate with its own distinct offer in the energy market. This configuration does not prohibit self-charging by using the on-site generator to charge the energy storage resource. Co-located Variable Energy Resource+Storage technologies configured as independent assets require additional metering and measurement points for the calculation of losses for each of the independent assets. This type of configuration requires an appropriate sized connection, and metering and measurement points that reflect the multiple points of supply. The required metering and measurement points are project dependent.

Figure 2 – Independent Asset configuration



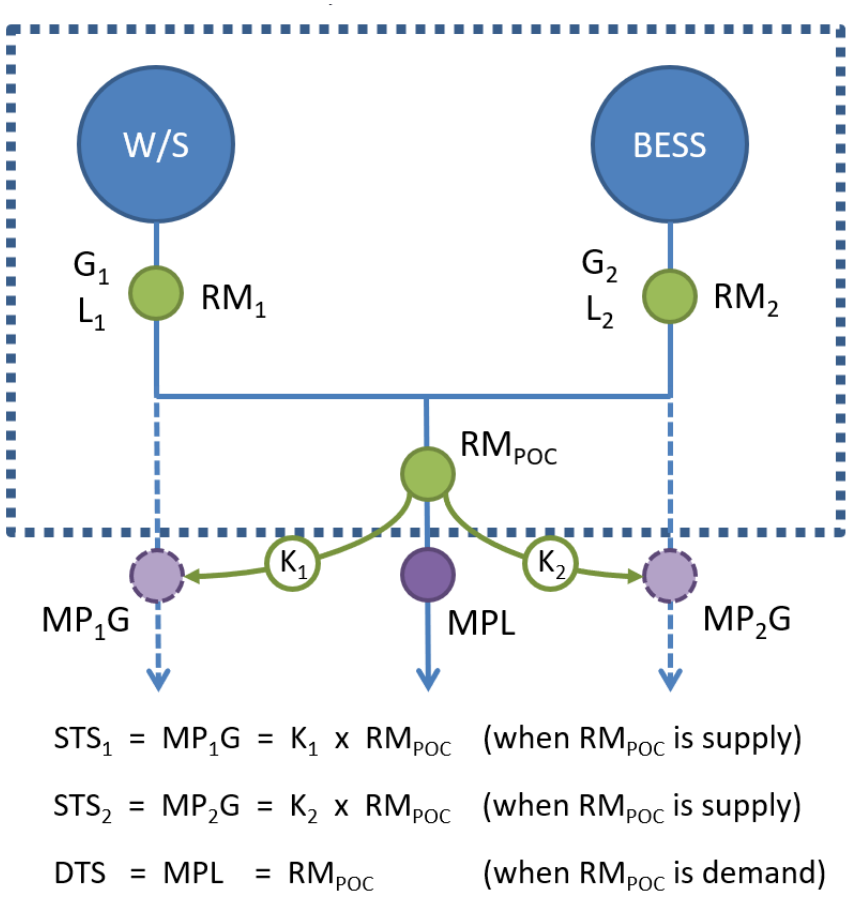
The figure above provides an example of the asset configuration for a site with energy storage combined with wind or solar where the participant has chosen to not bid the consuming operation of the ESR. In this example 3 assets are assigned, 1 sink asset to capture any inflows into the site from the grid, and 2 source assets. One source asset assigned to the on-site wind or solar resource and another source asset to represent the discharge capability of the energy storage resource. A sink asset assigned to charging the energy storage resource is not required. The red/pink lollypops represent where the dispatch compliance point would be measured. The green lollypops indicate where financial settlement of the energy production will be determined. The yellow lollypops indicate where financial settlement of the energy consumption will be determined.

Figure 3 below explains the meter math involved in determining the energy flows on a site with co-located technologies. The real power meters (RMx) are installed on the high voltage side of the transformer of the site as well as at the terminus of the storage (B) and the wind/solar facility (W/S). Measurement points are calculated for the outflows (MPxG) and the inflows (MPL) from all resources at the facility. MP1G and MP2G are used for the determination of losses and the calculation of loss factors if the assets are to be dispatched independently.

SAS contracts must be applied to flows at the point of connection (POC) to the transmission system. The revenue meter (RM) at the POC can be split into measurement points (MP) for two STS contracts by applying the ratio of the each generator output to the total generation by the formula Kn = RMn / (RM1 + RM2)

A single DTS contract at the POC for the entire facility allows for self-charging.

Figure 3 – Energy Measurements for co-located resources that are dispatched independently



Market participants are encouraged to initiate conversations about asset configuration with the AESO early in the connection process to ensure adequate time to address these matters.

Option 2: Offer all resources on site as a single source asset.

In this configuration the AESO will assign a single source asset to dispatch and settle any energy outflows and a single sink asset to settle any energy inflows.

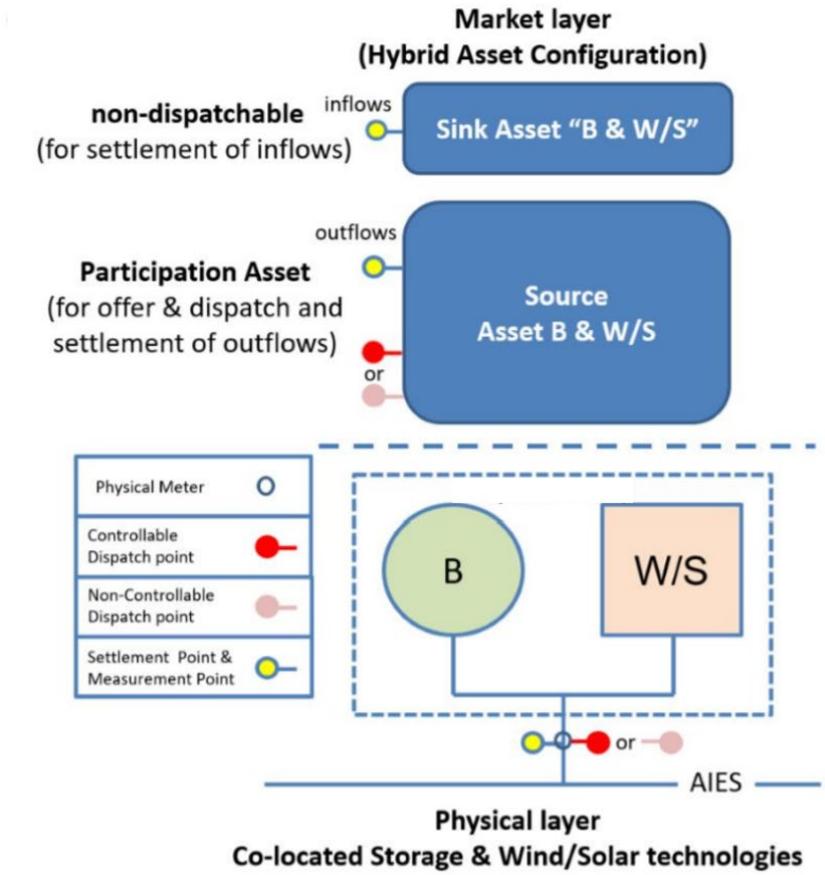
A participant can choose this configuration with any combination of co-located technologies; however, the term “hybrid” asset is restricted by rule to be only those assets whose underlying technologies are wind or solar in combination with energy storage resources. Any other combinations of technologies are not considered hybrids. Hybrid assets are considered partially controllable and have characteristics of both variable energy resources (wind or solar) and energy storage resources. Hybrid assets require additional information to be submitted with the offer, have a more complex dispatch instruction, and have additional compliance obligations.

Figure 4 – Example of co-located technologies operating as a single source asset:

The AESO advise participants to consider hybrid operation only if the ability to offer each on-site resource as separate registered source assets is not possible or difficult to operate.

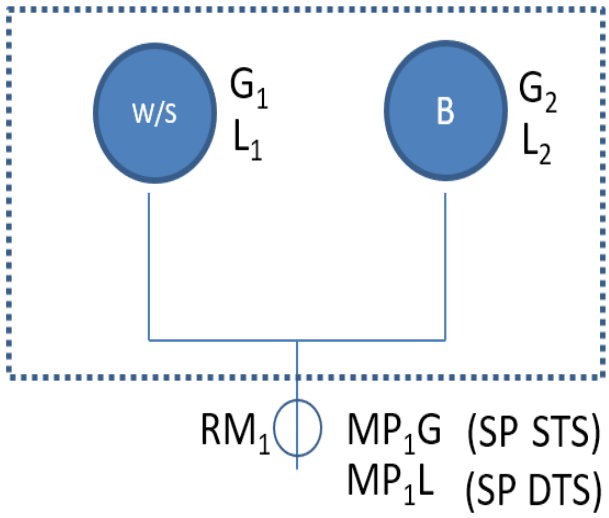
Examples of where this might be the case is when both the energy storage resource and the variable energy resource share the same inverter, or the transformer rating is less than the capability of the resources behind it.

Figure 5 – Hybrid Asset Configuration



Co-located VER+Storage technologies configured as a single asset require metering and measurement points for the calculation of losses for the entire site. As illustrated in Figure 6 below, the real power meter (RM1) is installed on the high voltage side of the transformer of the site. Measurement points are calculated for the outflows (MP_1G) and the inflows (MP_1L) from all resources at the facility. Settlement points (SP STS and SP DTS) are based on revenue-level metering and used for energy and STS (losses) and DTS settlement.

Figure 6 – Hybrid Asset Metering



See the following section for an explanation of the variable energy resource quantity and how it is used to determine dispatch compliance.

Market participants are encouraged to initiate conversations about asset configuration with the AESO early in the connection process to ensure adequate time to address these matters.

4 Hybrid operation

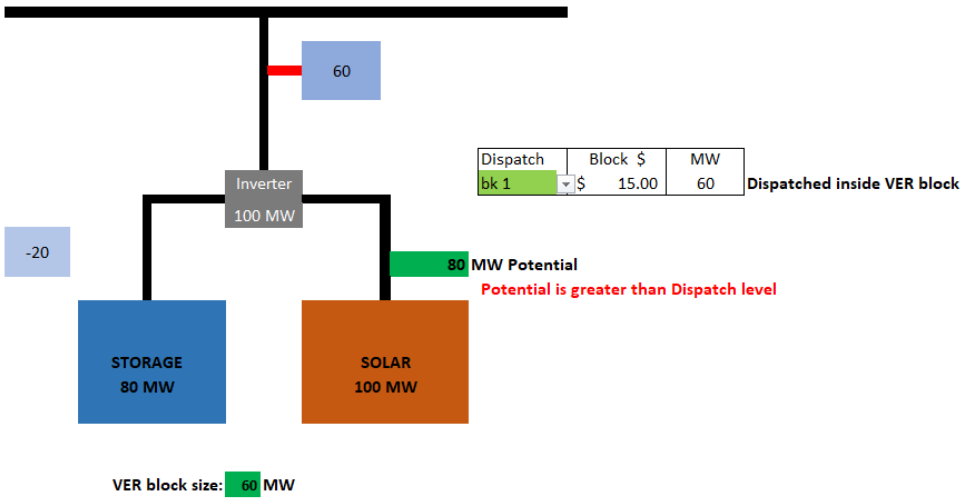
The AESO has implemented specific rule changes for the hybrid asset configuration. Hybrid assets are considered partially controllable and have characteristics of both variable energy resources (wind or solar) and energy storage resources. Hybrid assets require additional information to be submitted with the offer indicating the MW volume of the asset that is to be associated with the variable energy resource component. An additional column called the “VER block" is included on the ETS submission screen for source assets that are VER-Storage hybrids (i.e., wind or solar with storage). This allows the asset to remain in dispatch compliance when directing the energy from the variable energy resource to the grid or to charge the on-site storage.

The following formulae are used to assess expected output:

- When the dispatch level of the asset is less than or equal to the VERBlock volume, the expected asset output to the grid (Alberta’s interconnected electric system) should be equal to the lesser of the potential real power as determined by the meteorological data or the dispatch level, plus or minus the allowable dispatch variance.
- When the dispatch level of the asset is greater than the submitted VERblock volume, the grid output of the asset should be equal to the lesser of the dispatch level or dispatch level minus the VERblock volume, plus the potential real power as determined by the meteorological data, plus or minus the allowable dispatch variance.

Figure 7 below provides an example of how a hybrid site would be expected to operate if dispatched at a level equal to the VERblock volume and the solar potential is greater than the dispatch level. If dispatched to 60 MW and the solar potential is 80 it is expected that 60 MW would flow to grid and 20 MW to the storage.

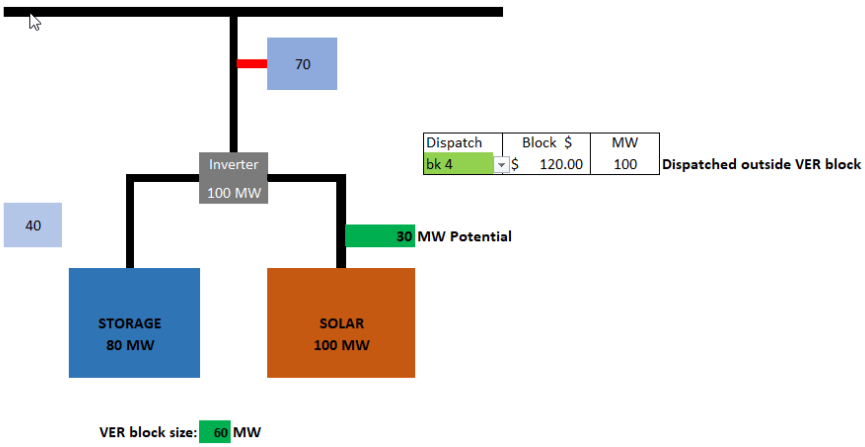
Figure 7 – Partially Controllable Asset dispatch example #1



If the solar potential dropped from 80 MW to 30 MW, due to cloud cover for example, then the expected output to the grid would be equal to the solar potential of 30 MW despite being dispatched to a level of 60 MW.

In figure 8 below the asset is dispatched to a level higher than the submitted VERblock. In this example, the asset is dispatched to 100 MW; however, the expected delivery to the grid is 70 MW based on the above formula (100MW dispatch level minus 60 MW VERblock size, plus the 30 MW of solar potential).

Figure 8 – Partially Controllable Asset dispatch example #2



The storage component of the asset is expected to provide an additional 40 MW of energy above what is generated by the solar component.

The party responsible for submitting the offers for a hybrid asset will be required closely manage the block prices, MW volumes, and VERblock volumes to ensure the asset is compliant with ISO dispatch rules.

5 State of Charge

This subsection refers to state of charge treatment within the ISO rules. The AESO has adopted the phrase “state of charge” to describe the level of charge of an energy storage facility relative to its capacity. In its information documents, the AESO refers to state of charge in relative percentage terms. The normal operating limits of an energy storage facility are represented as, in relative terms, 100% when an energy storage facility is completely charged and 0% when an energy storage facility is completely discharged. These relative terms of 100% and 0% are not intended to represent an absolute state of charge.

The AESO will include the normal operating limits in the applicable functional specification for the energy storage facility. Real-time state of charge information will be provided to the AESO through SCADA.

4 Application of Reliability Standards to Energy Storage Facilities

For the purposes of applying the requirements for Alberta reliability standards, an energy storage facility will be considered an aggregated generating facility.

If an energy storage facility is installed with another aggregated generating facility and system access service(s) for these facilities is provided through a common switchyard, then the AESO will use the combined maximum authorized real power rating of these facilities (i.e. maximum authorized discharging power for the energy storage facility plus maximum authorized real power for the aggregated generating facility) in determining the applicability of a reliability standard to each of these facilities. For example, if an energy storage facility that has a maximum authorized real power rating of 15 MW is installed at a wind aggregated generating facility that has a maximum authorized real power rating of 55 MW and system access service for these facilities is provided through a common switchyard, then the AESO will use the combined maximum authorized real power rating of 70 MW in determining the applicability of a reliability standard to each of these facilities.

Revision History

Posting Date	Description of Changes
2024-04-25	Updates to align with new Energy Storage Resource ISO Rule amendments and definitions. New information on energy storage site configurations and hybrid operations was added to the document.
2020-06-19	Initial Release