Criteria and Conditions used in Interconnection Studies of Battery Energy Storage Systems

Approaches when the Battery is in Charging Mode

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SYSTEM PLANNING

Agenda

- Describe the criteria and conditions used in interconnection studies of Battery Energy Storage Systems (BESS)
  - Focus on charging mode
- Describe the rationales for the current approach

Background

- The criteria and conditions to be used in the interconnection studies for new generation (including BESS) are described in Planning Procedure 5-6 - Interconnection Planning Procedure for Generation and Elective Transmission Upgrades (PP5-6)
- Jupiter Power made a presentation to the December 2021 Reliability Committee (RC) questioning some of the assumptions used in the study of BESS and proposing consideration of assumption changes
- ISO agreed to present the current approaches and the rationales for those approaches

CURRENT APPROACH

Study criteria and conditions when the BESS is in charging mode

PP5-6: Interconnection Planning Procedure for Generation and ETUs

- **10.0 Additional Considerations for Generating Facilities that include Storage:** The study of the discharging (i.e. generating) operating condition of a proposed electrical storage facility shall use the same study approach described in this procedure as that used for a Generating Facility. The charging operating condition shall be studied under similar conditions to the conditions used when studying the discharging mode to ensure the charging operating condition does not introduce reliability criteria violations, diminish transfer capability or increase conditional dependence in accordance with the requirements of this Planning Procedure.

No Degradation of Transfer Capability

- To ensure no degradation of transfer capability, the relevant interfaces (including import interfaces) are set at their limits before the new facility is added
- PP5-6 allows for re-dispatch of existing facilities when the new facility is added
  - Existing generation can be turned down when new generation (including discharging batteries) is added
  - Existing batteries in the charging mode could be switched off when a new battery in charging mode is added
  - Existing generation could be turned on when a new battery in charging mode is added, however, note the limitation on the introduction of conditional dependence on the next slide
  - Additional note, cannot re-dispatch more MW than is being added (either as charging load or as generation)

No Increase in Conditional Dependence

- The re-dispatch of existing facilities, described on the previous slide, cannot introduce a conditional dependence
  - Not acceptable that the new facility can only run when a certain existing facility(ies) is/are "forced" on in the study
    - Cannot create a "must-run" situation for an existing resource
    - Not acceptable to only be able to run under such a specific and dependent circumstance
  - It would be acceptable to turn on generation in the study, when adding BESS in the charging mode, to relieve a constraint, if MW from any of several existing generators could relieve the constraint

The Standard has Symmetrical Treatment for Generating and Charging Conditions

- Export constraints can be very relevant for new generation
  - At light load, a new generator has to be able to fully dispatch at the requested capability when no neighboring existing generation (that would contribute to a constraint) is running
  - At peak load, a new generator in an export-constrained area would have to increase the export capability if the new generation was large enough that all of the existing generation could be turned off under re-dispatch but the export level was still above the transfer capability
- Similarly, import constraints will be relevant for a BESS in the charging mode (the charging adds to the load in the importing area)
  - At peak load, the import constraint will be stressed
  - While re-dispatch can be used in the study (as described on the previous two slides), if there are no re-dispatch options, then the import capability would have to be increased to provide interconnection service that meets the standard to the new charging load

RATIONALES FOR THE CURRENT APPROACH

Reasons for the study criteria and conditions when the BESS is in charging mode

Storage May Need to Charge at Peak Load

BESS comes to the market with many capabilities

- Example: regulation
  - Batteries can switch rapidly and seamlessly between discharging and charging mode to provide regulation or frequency response
  - This switching could be needed/used at any load level, including peak load

Storage May Need to Charge at Peak Load (Continued)

- Storage is proposed to provide smoothing and reliability for the more variable power system in the future
- Example: Duck curve
  - If there is excess solar or wind production during hot summer afternoons, storage can absorb this excess by charging during the afternoon and then discharging after the sun goes down
    - This is the opposite of the old "charge at night and discharge during the day"
  - Such responses by storage would be in response to price and not in response to regional load level
    - Price can be suppressed by excess intermittent production, even at peak loads

Appropriate Level of Analysis to Convey Interconnection Service

- The Interconnection Standard does not have a concept of conditional service
  - The standard does not have a concept where a facility would not be allowed to run under certain system conditions, such as above or below a certain regional load level
- The new facility must be able to run at the requested capability under the conditions of study
  - Remember that this is still "minimal" in the sense that existing resources can be re-dispatched as described earlier in the presentation
- Once interconnected, and after paying for any upgrades, generation does not pay for the use of the transmission system, but is pointed to as the Network Resources that are used to serve the load and therein are free to participate in the participate in the markets fully as Network Resources, subject to security constrained economic dispatch and the related energy and ancillary service market rules

Market Implementation

- The current market implementation does not have a concept of limiting production or usage based on the prevailing system load level (or load pocket load level)

Interconnection Points Without Upgrade Costs are Available

Upgrades Often Required at Lower Load Levels

- When we see overloads for BESS charging at peak load, it is common to also see the overloads at shoulder or even light load
  - Because the addition of larger charging loads can be sufficient to still overload lines, even when there is lower system load

Placement and Sizing

- There are many cases of BESS projects that have not caused overloads when charging
  - Well sized and located projects have not required upgrades when charging at peak load

Next Steps

- Consider the RC feedback on the topics discussed today
- Discuss any next steps with Jupiter Power and others

Questions