Storage as a Transmission Asset (SATA) Phase 1 PJM Package Proposal – PC Endorsed Dec 2020

Jeffrey Goldberg, Sr. Engineer II
Transmission Planning

Operating Committee

March 6, 2025

Package Guiding Principles

- Phase 1 is limited to Storage as Transmission Asset only
- Phase 1 goal is to provide transparent evaluation rules:
  - to establish a review of SATA to provide a comparison to typical “wires solution”
  - to establish SATA RTEP requirements to ensure implementation maintains system reliability consistent with NERC standards
- PJM’s SATA evaluation approach ensures there are no adverse impacts to the PJM Interconnection Queue
- Phase 1 reliability requirements must be established in order to ensure Phase 2 dual use does not adversely impact reliability requirements.

PJM Package Proposal – Design Component 1

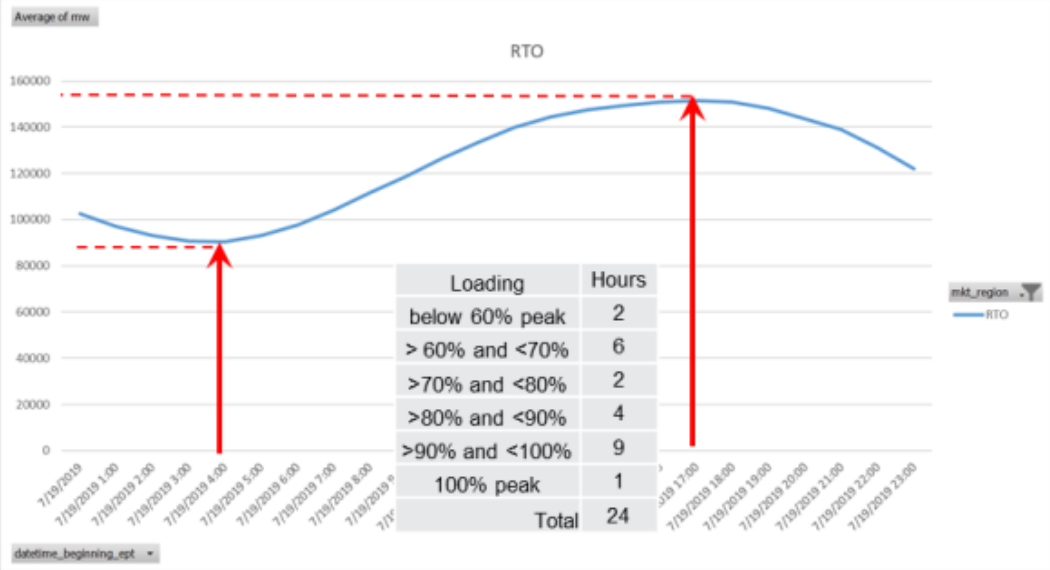
#	Category	Design Components	A
1	Reliability	Sensitivity cases to ensure compliance with Planning criteria	SATA sensitivity with it charging and discharging in the study case

- SATA model considerations
  - Appears in the Base Case – SATA in standby
  - Appears in Sensitivity cases – SATA as a generator and as a load

- These sensitivity cases would apply to:
  - M14B, Section 2.3.6 Baseline Thermal Analysis
  - M14B, Section 2.3.7 Baseline Voltage Analysis
  - M14B, Section 2.3.8 N-1-1 Reliability Analysis
  - M14B, Attachment C.2 Load Deliverability
  - M14B, Attachment C.3 Generator Deliverability
  - M14B, Attachment C.4 Long Term Deliverability Analysis
  - M14B, Attachment D.2 Light Load Reliability Analysis
  - M14B, Attachment D.3 Winter Peak Reliability Analysis

PJM Package Proposal – Design Component 2

#	Category	Design Components	A
2	Reliability	Forecast mechanism to model daily load curves to within an acceptable margin of error, in relation to 5-year planning studies	SATA must be sized appropriately to mitigate the reliability violation for a minimum duration based upon sensitivity analysis using granular load curves, as available. If granular load curves are not available, SATA must be sized to mitigate the reliability violation for a minimum of 4-hours, based on Long-term Emergency Rating.



In the absence of a granular load curve

- The seasonal Emergency Rating Limit is typically defined as a 4-hour continuous rating.
- The SATA solution, at a minimum, must maintain post-contingency flows and voltage magnitudes within the seasonal emergency rating limits for the most aggravated system condition

PJM Package Proposal – Design Component 3

#	Category	Design Components	A
3	Reliability	Generator Interconnection Study criteria - special cases to consider	SATA sensitivity with it charging and discharging in the study case. The sensitivity case charge/discharge rates to be consistent with worst case violation studied rates. Charge and discharge will not be studied at the same peak/valley case.

- To ensure that system conditions do not constrain SATA operations, the SATA must be studied with sensitivity cases to ensure reliability for all SATA modes of operation.

- For all PJM reliability analysis in which SATA is present in the study case, the SATA should be modeled in its standby mode. However, additional sensitivity cases must be studied for Do No Harm analysis; one sensitivity case with SATA injecting power pre-contingency, and another sensitivity case with SATA consuming power pre-contingency.

PJM Package Proposal – Design Component 4

#	Category	Design Components	A
4	Reliability	Design for violation and identify its role as a harmer or a helper on other criteria tests	PJM will complete do-no-harm testing utilizing the capability of the controls as specified by the proposing entity Proposing entity identifies any additional violation mitigation or help

- PJM performs Do-No-Harm analysis for all RTEP projects; whether a traditional wires solution or a SATA solution
- SATA will be modeled in the study case for its full charge / discharge capability as specified by the proposing entity
- Identification of additional benefits beyond the intended violation mitigation should be identified by the proposing entity

PJM Package Proposal – Design Component 5

#	Category	Design Components	A
5	Reliability	Performance expectations requirements	Ensure SATA capability is able to meet performance requirements for the life of the facility, while recognizing the unavailability of asset while charging

- SATA state of charge and readiness must be maintained to ensure reliable violation mitigation.
- SATA unavailability during charging must be considered for suitability in violation mitigation.
  - SATA would be unsuitable to mitigate Normal violations.
- Lifespan of SATA major components (i.e. batteries, inverters, GSU transformers, etc.) must be considered such that the SATA system as a whole can meet performance requirements for the life of the facility.
  - Proposing entity must provide the details regarding asset renewal as required to meet nominal lifespan

PJM Package Proposal – Design Component 6

#	Category	Design Components	A
6	Reliability	Allowable modes of operation	SATA must be at the desired state of charge and available to mitigate the violation as intended. SATA operating types may include: 1) Pre-contingency response (automatic) 2) Post-contingency response (automatic) 3) Local load security (automatic)

- All SATA facilities shall be configured for local automatic operation, and capable of responding to contingencies instantaneously.
- The facilities should also provide for local manual operational control.

PJM Package Proposal – Design Component 7

#	Category	Design Components	A
7	Reliability	Charge and discharge schedules and responsibilities	PJM establishes timeframes when charge and discharge schedules can be accommodated and will be documented in operating procedures. Asset owners responsible for maintaining state of charge and submitting schedules to PJM. Submitted schedules would accommodate single peak and multi-peak days with allowance for off peak recharging.

- In consideration of RTO independence, PJM cannot directly control the SATA charge and discharge functions.
- PJM will provide the timeframes for charge and/or discharge functions for restoring state of charge.
    - Guideline for timeframes will be documented in operating procedures
- Asset owners are responsible for maintaining state of charge
    - Submit charge / discharge schedules to PJM for approval
    - SATA capacity and schedules must accommodate single or multiple daily peaks as necessary and allowing for recharging at off peak periods.

PJM Package Proposal – Design Component 8

#	Category	Design Components	A
8	Reliability	*Benefit measurements of SATA vs. traditional resources in reliability studies (subcomponents listed below)*	
8a	Reliability	Cost elements	SATA estimated life should be a composite of all the major components (i.e. battery cells, inverters, GSU, auxiliary equipment). SATA will not participate in its markets but will use the appropriate settlement mechanisms to settle the charging and discharging functions to offset the rate of recovery
8b	Reliability	Additional benefits	Proposing entity identifies additional benefits

- For the anticipated lifespan of the entire SATA system, costs for replacing degraded major components during the SATA lifetime must be provided by the proposing entity at the time of project proposal.
- Costs associated with charging and discharging will use market settlement mechanisms to offset transmission asset cost recovery.
- Proposing entity shall communicate additional benefits for consideration

PJM Package Proposal – Design Component 9

#	Category	Design Components	A
9	Reliability	Lifespan and retirement considerations	Components of SATA can be replaced as needed. At PJM's direction, SATA can be relocated to a different area of the system when system needs change. This would be driven by a baseline reliability study.

- Consistent with Design Component 5, degraded SATA major components (i.e. batteries, inverters, GSU transformers, etc.) must be replaced as needed such that the SATA system as a whole can meet performance requirements for the life of the facility.

- Retirement of a SATA asset or relocation to another area of the grid must be supported by a PJM baseline reliability study.

PJM Package Proposal – Design Components 10, 11, 12

#	Category	Design Components	A
10	Market Efficiency	Generator Interconnection Study Process - special cases to consider (IARRs)	Status Quo
11	Market Efficiency	Allowable modes of operation	Status Quo
12	Market Efficiency	Charge and discharge schedules and responsibilities	Status Quo

- The current PJM rules, study procedures, and tools have been reviewed for adequacy in assessing SATA for Market Efficiency.
- The findings are that there are no gaps in the status quo for Market Efficiency analysis as the current tools and analysis techniques are already sufficient to study and assess SATA.
- The recommendation is that no SATA specific rule changes are required

Contact

SME/Presenter:
Jeff Goldberg,
Jeffrey.Goldberg@pjm.com

Storage as a Transmission Asset

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com