Storage As a Transmission Asset (SATA) Working Item - Education

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Operating Committee

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Guiding Principles

- SATA participation in PJM Markets is out of scope
- SATA operations should be similar to a typical wires solution
- Operational procedures should be as streamlined as possible
- SATA, during phase 2, is considered transmission only and not generation

What is **S**torage **A**s **T**ransmission **A**sset?

- SATA as we are looking to implement in Phase 2 discussion at PJM is:
  - Energy Storage that directly affects transmission power flows by injecting or withdrawing power as dispatched by transmission system operator to solve the reliability solution for which it was intended
  - SATA is compensated through regulated transmission rates (rate of return)

Industry Analysis -Summary Slide

RTO/ISO	SATA Policy	Transmission Only
MISO	Yes	Yes
ISO-NE	Yes	Yes
SPP	Yes	Yes
NYISO	No	N/A
PJM	No	N/A
SERC	No	N/A
CALISO	No	N/A

Industry Analysis cont…

RTO/ISO	Voltage	Type	In Dispatch Tool	Operational Process for Use
MISO	Not limited must impact BES	ESR (Battery)	No	Step by Step process under certain emergency conditions
ISO-NE	115kV +	(storage medium not limited)	No	System operator's manual activation
SPP	Not limited but must impact BES	ESR (Battery)	No	System operators operational control.

Usage

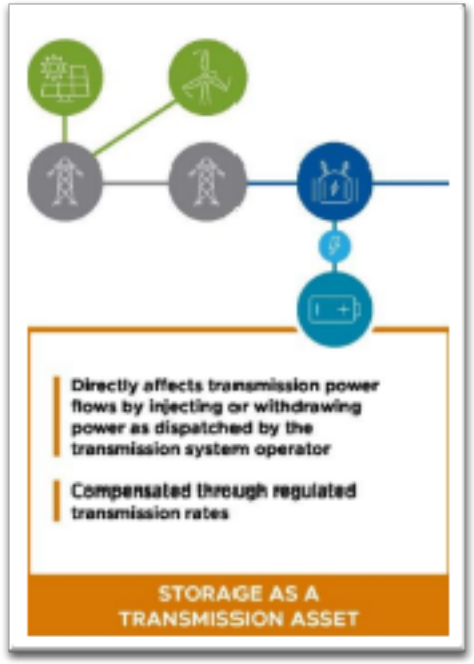
RTO/ISO	Responsibility for Charge/Discharge
MISO	**SATOA's owner** is responsible to charge the battery under normal conditions and discharge battery under emergency conditions. SATOA **operator coordinates with MISO's** control room to charge/discharge.
ISO-NE	Does not spell out the specific responsible party for but does speak to would only be used for emergency/rare situations
SPP	SATOA's market participation is limited to charging from and discharging to SPP's transmission system as needed to provide the service it was approved to deliver; and that the SATOA will be subject to SPP's operational control

“Energy Storage as a Transmission Asset”

Jeremy Twitchell, Devyn Powell, Prathit Dave, Christine Holland, Jessica Shipley PowerPoint Presentation

Defining Storage as Transmission

- Despite nearly two decades of policy guidance and regulatory precedent for the use of energy storage as a transmission asset, transmission plans still rarely consider storage alternatives
- Regulators have assigned the responsibility for proposing storage alternatives to non-utility participants in the transmission planning process
- The lack of storage alternatives in transmission plans suggests that those participants may lack clarity about when storage alternatives merit consideration
- Our forthcoming paper, “Energy Storage as a Transmission Asset: Definitions and Use Cases,” provides clarity on this topic by defining the ways that energy storage can interact with the transmission system and the specific use cases in which storage alternatives may be viable



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Storage as a Transmission Asset Potential Study

Project Approach:

- Review all publicly filed regional transmission plans in the U.S. from 2021-2023, supplemented by review of individual utility plans in regions that do not produce a detailed regional plan
- Identify all contingencies modeled, the system need, the options considered, and the cost of the selected option
- Structured like an energy efficiency potential study, in which we will assess the **technical potential** (total number of contingencies in which energy storage could have met the identified need) and then the **economic potential** (total number of contingencies in which energy storage may have been a cost-effective alternative to the option that was selected)

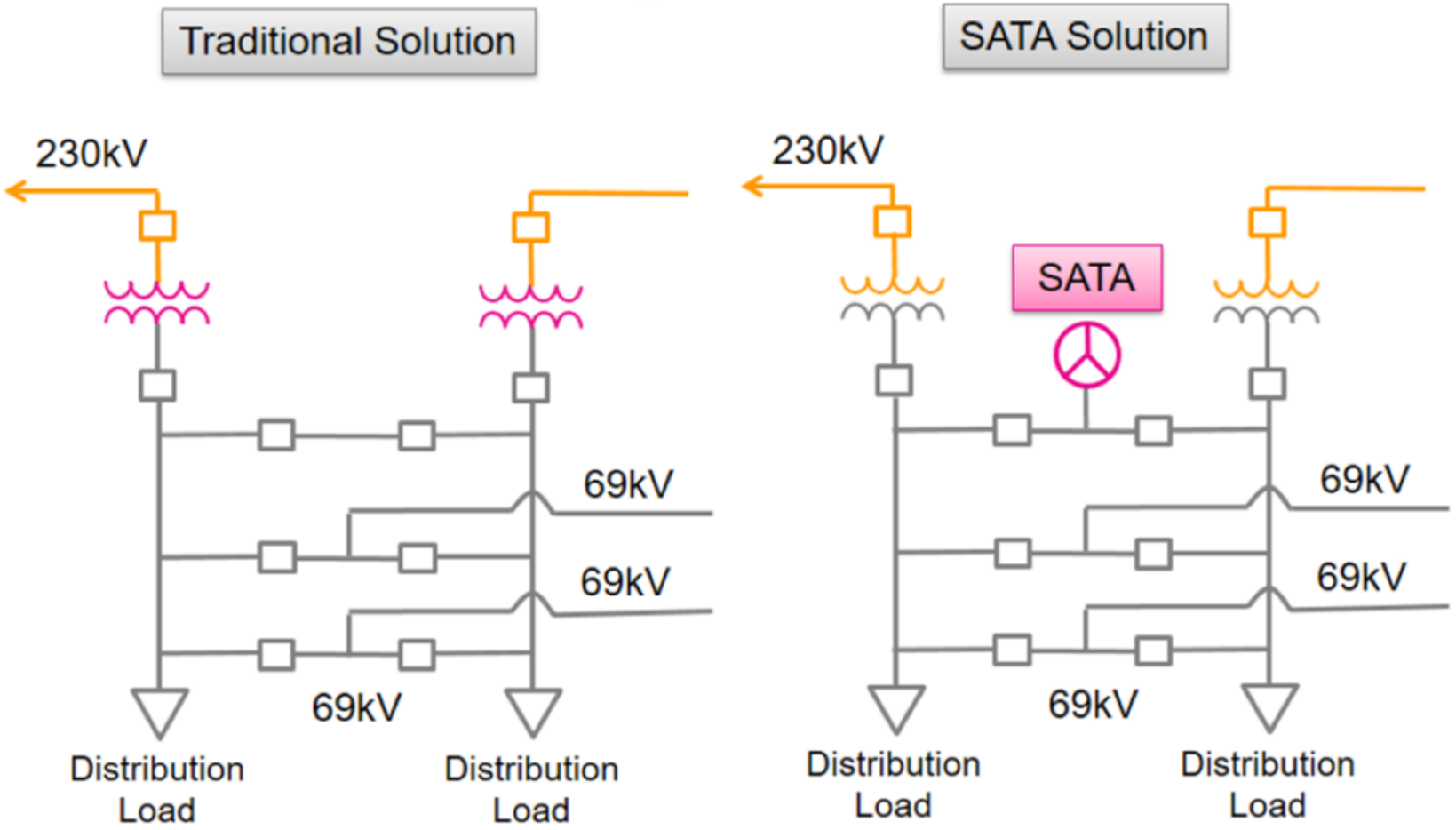
Expected Impacts:

- Technical potential study: indicate the number of scenarios in which storage could be a viable option to illustrate the range of services that storage can provide on the grid
- Economic potential study: provide an estimate of the potential market size for energy storage as a transmission asset to ascertain whether further policy guidance is warranted

Initial Findings

Region	SATA Policy in Place?	Number of Times Storage Considered in a Transmission Plan, 2021-2023
CAISO	No	2
MISO	Yes	0
ISO-NE	Yes	0
Northern Grid	No	0
NYISO	No	0
PJM	No	0
SERC	No	0
SPP	Yes	0
West Connect	No	0

Practical Example



1. Traditional Solution replaces two 230/69kV transformers that may not be at end of life (EOL) with larger transformers

2. SATA Solution installs (interconnects) the storage asset at the 69kV bus for instantaneous post-contingency mitigation

3. The SATA is modeled as ESR, with +/- MW's and state of charge

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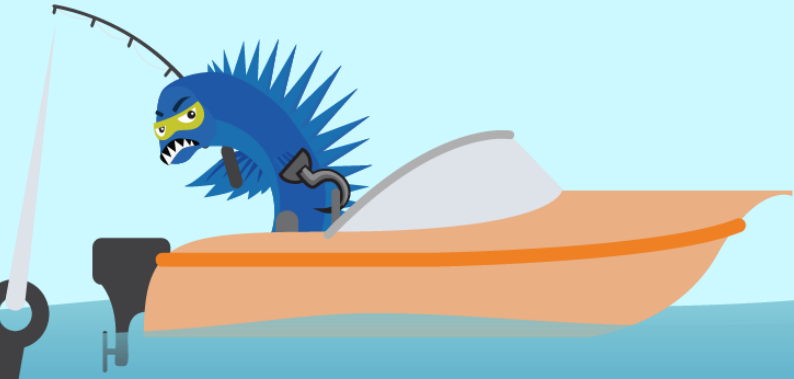

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Appendix

- ISO-New England describes SATOA as an energy storage device connected to the pool transmission facility at 115 kV or higher, which can inject stored power to address transmission system requirements. The storage medium will not be restricted, ISO said: Batteries, air, water and other materials are acceptable.
- The storage as a transmission-only asset will not be included in the grid operator's market dispatch and pricing software or counted toward available reserve capability, ISO-New England said. The resources would instead be purpose-built as transmission equipment.
- System operators could activate a SATOA to provide power by relieving the strain on the transmission line, ISO-New England said.

ISONE cont…

- Use Case: The grid operator said such a system could be used in a rare situation when a municipality loses two of three transmission lines in a storm and the third line is overloaded, threatening an outage.

MISO

- MISO leads the way with energy storage as a transmission only asset (SATOA) – 2020
- The criteria to evaluate and select SATOA – When evaluating a storage project as a transmission-only asset, the storage project must follow transmission planning protocols. The storage developer must respond when the transmission provider, as per FERC order 890, sends out a notification soliciting project ideas. The SATOA will be evaluated like any other project suggested for a system need.

MISO Cont…

- The criteria to choose a SATOA over a wire's alternative is focused on the effectiveness of SATOA – whether the battery will discharge when needed, and charge only when the system conditions are normal. Additional criteria include whether or not the SATOA has a 40-year asset life like a transmission alternative and if the cost is lower than the other alternatives.
- Impacts on wholesale energy markets – There are none. Since storage is not a market resource and storage operating as a transmission-only asset is like a transmission switching station, the SATOA owner's responsibility is to charge the battery under normal conditions and discharge the battery under emergency system conditions. The SATOA operator coordinates with the MISO control room operator for charging and discharging.

MISO Cont…

- SATOA cost recovery – Since SATOA is a transmission facility operated strictly for reliability need on the system, and MISO has authority over the asset in their role as a Reliability Coordinator (RC) – recovery of SATOA costs from the rest of the transmission system operators is similar to other transmission facilities costs.
- Impacts to generator interconnection queue – There are none. SATOA does not go through the interconnection queue because it is not a network resource.
- SATOA operating guides – MISO and other transmission system operators have standard operating guides that provide step-by-step instructions to follow a path under certain emergency system conditions. This action is what operators do in the control room. The need for familiarity with current operating guides is another reason why system operators undergo training to keep their NERC certification. The operating guide documents each SATOA operation.

- On May 26, 2023, the Commission accepted Southwest Power Pool, Inc.'s ("SPP") proposed revisions to its Tariff to establish the "framework under which an electric storage resource may be considered a transmission asset."
- The Commission found that SPP's proposed revisions ensure that a SATOA will serve a transmission function. First, under SPP's proposed revisions, a SATOA "must be connected to the transmission system as a transmission facility solely to support SPP's transmission system." The proposed SATOA must also be identified as the preferred solution to resolve a transmission issue in SPP's transmission planning processes.

SPP cont…

- In addition, FERC provided that the transmission issue to be resolved by the SATOA cannot be addressed by a market solution; that SATOA's market participation is limited to charging from and discharging to SPP's transmission system as needed to provide the service it was approved to deliver; and that the SATOA will be subject to SPP's operational control.

SPP cont…

- With regard to cost recovery, the Commission approved SPP's proposal to use the appropriate existing transmission cost allocation and recovery methods that apply to the relevant type of transmission project for which the SATOA qualifies under SPP's Tariff. The Commission reasoned that given that the scope of a SATOA is restricted to performing transmission functions, it is appropriate for the SATOA to recover costs in a manner consistent with the existing transmission facilities within the same category of the transmission project.

- November 2023 - Energy storage resources may provide many potential services and have positive impacts on the transmission system due to their operating characteristics and favorable development considerations. Under the NYISO tariff, energy storage is currently treated as a Generator and, therefore, may not be considered as a solution to an identified transmission need. Utilizing storage as a regulated asset to meet a transmission system need, rather than participating as a Generator in wholesale markets, is known as storage as transmission or “SAT”.

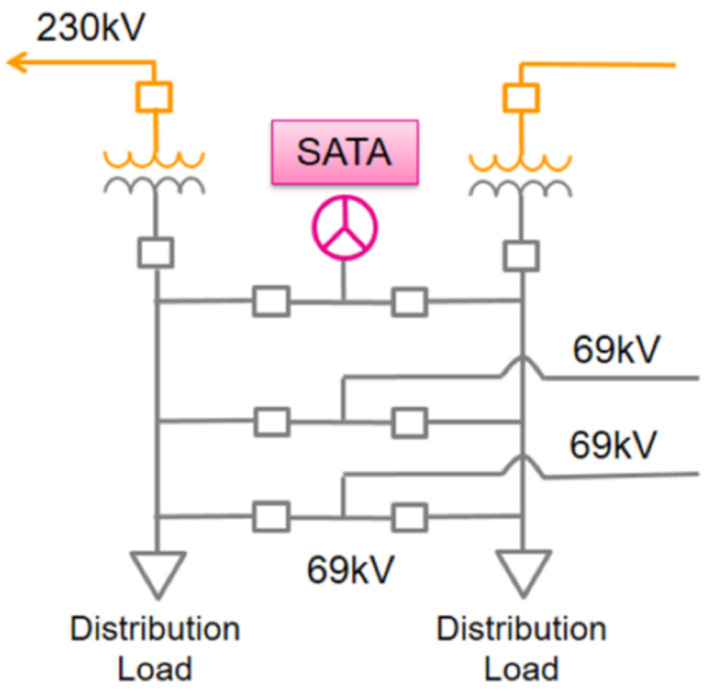
NYISO Cont…

- Based on the analysis to date, the NYISO recommends continued exploration of Storage as Transmission in 2024. A potential NYISO model would (1) address the eligibility of a storage resource to address a transmission need and receive cost-based rate recovery, (2) consider how SAT will be assessed in the NYISO planning process, and (3) address the expected operation of a storage resource to address a transmission need.

Sources

- https://www.renewableenergyworld.com/power-grid/transmission/miso-leads-the-way-with-energy-storage-as-a-transmission-only-asset-satoa/
- https://www.spp.org/documents/69469/itp%20manual%20version%202.14a.pdf
- https://www.iso-ne.com/static-assets/documents/2022/04/a5_storage_as_transmission_only_asset.pdf
- https://stakeholdercenter.caiso.com/StakeholderInitiatives/Storage-as-a-transmission-asset
- https://www.nyiso.com/documents/20142/41393553/Storage%20as%20Transmission%20Report.pdf/5c4d7649-2fb7-e165-2aae-999863f7f9cf#:~:text=Under%20the%20NYISO%20tariff%2C%20energy%20storage%20is,as%20a%20solution%20to%20an%20identified%20transmission

Typically when PJM adds a storage asset we model it the following:

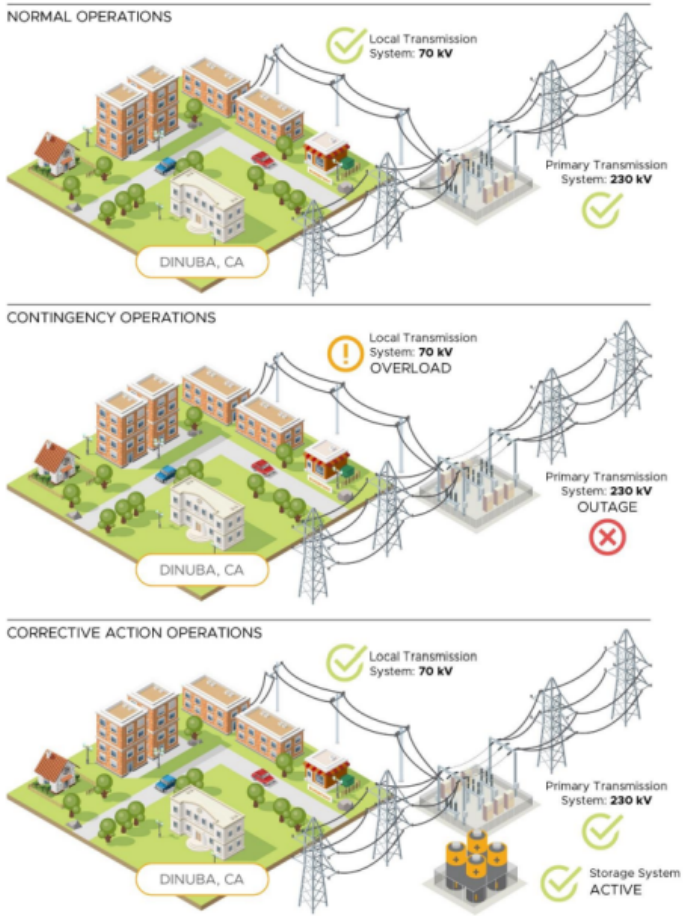


ESR – modeled as a generator

Details:

- MW's can go negative (charging)
- MW's can go positive (discharging)
- State of charge

Example from PNNL.gov



How storage can resolve transmission system contingencies