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Energy Storage Developments: Responding to Order 841

ESIG Spring Technical Workshop

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Energy storage is a game-changer for energy systems integration

So how must the game change?

Order 841 provides some hints…

What Order 841 Does & Does Not Do

- Order 841 removes barriers to storage by requiring RTOs to implement a "participation model" that…
  - Enables storage to provide all market services technically capable of providing
  - Implements bidding parameters to reflect physical & operational characteristics
  - Enables storage projects as small as 100 kW to participate (including DER storage)
  - Regularizes buying and selling of energy at wholesale for storage
  - Is effective by December 2019
- Order 841 does not…
  - Create or modify market products
  - Amend interconnection, transmission planning, or other RTO functions
  - Require larger changes to commitment, optimization, scheduling, and dispatch

Concerns in RTO Order 841 Compliance Plans

- PJM
  - Dispute 10-hour duration for capacity qualification and market participation
- MISO
  - Dispute application of transmission fees to storage charging at ISO instruction
- ISO-NE
  - Object to automatic redeclaration of storage energy output to meet reserve requirements
- NYISO
  - Object to bias against self-management of state of charge & lack of make-whole payments for storage in capacity market
  - Object to modifications of market mitigation rules
- Cross-cutting
  - Lack of or inappropriate utilization of commitment parameters (PJM, ISO-NE, NYISO)
  - Barriers to dual participation of DER storage (MISO, NYISO)
- Prospective
  - Lack of clarity for how to apply to hybrid resources (i.e., storage + generation)
  - Unclear market mitigation rules

Capacity Value of Storage

- PJM proposes to base ICAP on non-hydro storage output over 10 hours
  - Based on 20% penetration of storage = 30 GW of storage (!)
  - Based in part on PJM 2010 DR study
    - Assumes simultaneous dispatch of capacity resources, not efficient dispatch
    - Focuses on duration of high loads alone, does not examine impact of varying duration of generator outages
- ESA disputes PJM proposal as inappropriate barrier to capacity market
  - Forthcoming ESA-commissioned study finds 4 GW of 4-hr storage & 10 GW of 6-hr storage would contribute full capacity value
  - Mirrors current dispute in NYISO over capacity value by duration
- Uniform “capacity value” in tension with heterogeneous resources
  - Storage has energy limitations
  - Generators have forced outage conditions
  - Renewables lack dispatchability
  - Demand resources are block-loaded

Different reliability contribution profiles → relative capacity contributions, which may change with supply mix

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Commitment & Optimization and Storage

- RTOs vary in approaches, but each raises issues
  - PJM & ISO-NE both do not implement state of charge as a bidding parameter, lack means to optimize in DA even if implemented → potential for infeasible schedule
  - NYISO requires ISO-management of state of charge for storage in capacity market pursuant to DA schedule, lack of make-whole payments → potential for dispatch that harms economics
- Tension between flexibility/lack of commitment needed for battery storage and markets built on commitment logic
  - Energy markets → RT participation and self-scheduling generally ideal, do not need DA optimization
  - Capacity markets → generally require offer obligations, need DA optimization
    - MISO limits offer obligations to hours coincident with peak
- Storage with transition times (e.g., pumped hydro, compressed air) may need DA optimization
  - Longer-duration storage may seek multi-day optimization

Dual Participation of DER Storage

- While 100 kW units may participate, overall DER storage participation can be unclear
  - MISO proposes to limit and phase in “very small” storage participation
  - NYISO proposes to require BTM storage to elect only wholesale or only retail energy – de facto prohibition on dual participation
  - Subject to FERC rehearing on state authority to regulate DER participation
    - Compromise offered by AR PSC
- Important for both behind-the-meter storage and front-of-meter distribution-connected storage
  - Multiple-use frameworks sought to maximize utilization and value of storage for grid
- Challenges on accounting for wholesale versus retail transactions, method for conflicting dispatch
  - CA and NY seeking to enable dual participation providing guidance from retail side
  - More detail to come in FERC Docket RM18-9 on DER participation

Market Mitigation and Storage

- Concerns over unclear or onerous market mitigation emerging
  - NYISO proposes buyer-side mitigation rules be extended to <2 MW storage
    - Tension with storage sited precisely to resolve a T&D constraint
  - Questions over cost-offer development in SPP, PJM
    - Management of limited energy → opportunity cost in addition to “fuel” cost and O&M cost
- Tension between strategies for de-rating / management of limited energy and mitigation logic of physical withholding
  - Compounded for dual participation storage meeting end-user and/or distribution system needs
  - ERCOT NPRR 915

Hybrid Storage + Generation Model

- Unclear how Order 841 will be applied to hybrid resources
  - ESA seeks a technical conference or notice of inquiry at FERC
- Several classes of issues merit addressing
  - Interconnection
    - Service below rated capacity
    - Material modification triggers
    - Queue & restudy issues
    - Configurations
    - Study methods
  - Market participation
    - Asset registration
    - Parameterization
    - Metering & configuration
    - Control & dispatch
  - Capacity valuation

Could be addressed piecemeal or as part of a "universal participation model"

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Order 841 Starting Other Conversations

- Market products & designs to take advantage of storage flexibility
  - Fast frequency control
    - ERCOT to implement first US market for fast frequency response
  - Load/supply-shift product (as opposed to arbitrage)
  - Flexible capacity & ramping
  - Improved energy price formation for flexibility
- Interconnection updates
  - Study methods that account for two-way controllability, varying configurations
- Storage-as-transmission
  - Transmission planning methods and data
  - Regulatory framework for ISO control, cost recovery, interactions with generation

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Thank you!

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