Kicking the Tires on FERC Order 841: Details, Opportunities, And Challenges

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In today’s webinar...

- The Significance of FERC Order 841
  - Jason Burwen // Vice President of Policy, ESA
- The Good, Bad, and TBD of Order 841
  - Mike Berlinski // Director, Customized Energy Solutions
- Sizing the Market After Order 841
  - Judy Chang // Principal, Brattle Group
- Next Steps Forward
  - Jason Burwen
- Q&A
THE SIGNIFICANCE OF ORDER 841
FERC Order 841 is a Big Deal

1. Creates a clear legal framework for storage resources to operate in all electric markets
2. Expands the universe of solutions that can compete to meet electric system needs
3. Represents necessary steps on the path to more flexible electricity system
Timeline of Order 841
Big changes happen slowly...

**Nov 2015**
- FERC Hosts Energy Storage Panel Discussion at Open Meeting, Following ESA Introductions
- ESA Identifies Barriers to Market Access for Storage, Makes Recommendation for Docket

**April-May 2016**
- FERC Opens Docket AD16-20 to Request Info on Storage Participation in RTOs/ISOs
- ESA Provides Comprehensive Inventory of RTO Market Rule on Storage, Makes Numerous Recommendations

**Nov-Jan 2016**
- FERC Issues NOPR in Docket RM16-23 on Electric Storage Participation in Organized Wholesale Markets
- NOPR Includes DER Aggregations as Well
- ESA Provides Further Recommendations to Improve the Rule

**April 2018**
- FERC Rules on Motions for Rehearing

**Feb-Mar 2018**
- FERC Issues Order 841
- FERC Calls Technical Conference on DER Issues in Docket RM18-9
- Motions for Rehearing Filed by Several Parties

**Lack of Quorum**

**Dec 2018**
- RTOs/ISOs Submit Compliance Filings for Order 841
- Opportunity for Replies to Filings

**Dec 2019**
- Deadline for RTO/ISO Implementation of Order 841

**2020-**
- Everything is awesome?
Why did FERC issue Order 841?

- “To remove barriers to the participation of electric storage resources in the capacity, energy, and ancillary service markets operated by Regional Transmission Organizations (RTO) and Independent System Operators (ISO).”
- “To enhance competition and, in turn, help to ensure that the RTO/ISO markets produce just and reasonable rates.”
- “Furthermore, due to electric storage resources’ unique physical and operational ... our actions here will help support the resilience of the bulk power system.”
“Electric Storage”

• “We define an electric storage resource as a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid.”

• Does not differentiate location on grid (e.g., transmission, distribution, or BTM)

• Includes non-battery technologies (e.g., pumped hydro, compressed air, flywheels)

• Excludes storage that delivers energy as heating/cooling service
  • Participates as demand response

• Excludes non-exporting BTM storage
  • Participates as demand response
What Order 841 Does

• RTOs/ISOs must file tariff amendments that establish a “participation model” for electric storage
  • Will also include changes to business practice manuals and software

• 5 sections of the Order
  • Storage is eligible to provide all capacity, energy, and ancillary services that the resource is technically capable of providing
  • RTOs/ISOs account for the physical and operational characteristics of electric storage resources through bidding parameters or other means
  • RTO/ISO minimum size requirements do not exceed 100 kW
  • Storage can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer
  • Storage will pay wholesale LMP for charging energy
Examples of Impact on RTOs/ISOs

- **SPP**
  - No participation model for storage - must register as a generator and as a load resource, which limits flexibility; insufficient bidding parameters
  - Dispatch does not take advantage of fast resource capabilities
  - Some progress had been made on a proposal for SERs (focusing on Frequency Regulation only) but has been on hold awaiting FERC Order

- **MISO**
  - Existing storage participation model (SER) limits participation to only Frequency Regulation
  - Capacity construct for storage limited to BTM (LMRs) with 4-hour duration
  - No explicit ability to derate capacity to qualify for and receive capacity credit

- **NYISO**
  - Fragmented participation options for storage—multiple asset classes (e.g. ELR, LESR) with different restrictions/allowances
  - No options for FOM resources under 1 MW
  - Work on new “ESR” asset class to fix issues began in response to Nov 2016 NOPR
THE GOOD, THE BAD, AND THE TBD FOR STORAGE
Intro to CES

• Founded in 1998
• 150+ staff
• Global
• 120+ MW of storage under management
• Advisors to ESA for many years
• Winner of ESA’s 2016 Brad Roberts Award

Mike Berlinski, mberlinski@ces-ltd.com
Order 841: The Good (1)

- Establishes a participation model that recognizes the physical and operational characteristics of storage resources
- Opens up all market products
  - Ensures resource using the storage participation model is eligible to provide all capacity, energy, and ancillary services that the resource is technically capable of providing
    - Facilitates participation in ISO markets, ISOs to improve market access, which will help resource economics
- Provides clarity around market access – tariffs will be explicit
  - ISOs to specify: (1) whether storage resources will participate through existing or new market participation agreements and (2) whether existing market rules apply to storage resources, including to provide capacity
    - Will clarify existing rules
  - Allows storage resources to de-rate capacity to meet minimum run-time requirements
    - Will confirm this ability, and enable resources to access more products in more regions
  - States storage de-rating its capacity to meet minimum run-time requirements for capacity or other services is not engaging in physical withholding
    - Avoids confusion with market monitor enforcement
Order 841: The Good (2)

• Improves dispatch flexibility and price formation
  • ISOs must represent the physical & operating characteristics of storage through bidding parameters or other means
    Account for: State of Charge, Minimum State of Charge, Maximum State of Charge, Minimum Charge Limit; Maximum Charge Limit, Minimum Charge Time, Maximum Charge Time, Minimum Run Time, and Maximum Run Time; and Minimum Discharge Limit, Minimum Charge Limit, Discharge Ramp Rate, and Charge Ramp Rate
    • Provides more control to resource owners, which could improve resource economics
  • Gives storage resources the right to manage their own state of charge
    • Provides more control to resource owners, which could improve resource economics
  • Storage can be dispatched and can set the wholesale market clearing price as both a wholesale seller and wholesale buyer
    • Clarifies this ability, and being able to set price can improve resource economics
  • Storage can participate as a price taker
    • Clarifies this ability
  • Allows storage resources to be eligible for make-whole payments
    • Clarifies this ability, and being eligible can improve resource economics
Order 841: The Good (3)

• Improves market access for distributed resources
  • Minimum size requirement for participation must not exceed 100 kW
    • Will enable the development of, or improve the economics of, small resources

• Ensures charging energy will be priced appropriately
  • Energy from ISO to storage resource that is resold back to ISO must be at the wholesale locational marginal price (LMP)
    • Clarifies this, which will maintain resource economics
  • Conversion efficiency losses to be settled at the wholesale LMP, and are not a component of onsite load
    • Clarifies this, which will keep costs down
  • Distributed storage resources cannot be forced to pay twice for charging energy
    • Will clarify this and keep costs down
  • Storage should not be charged transmission charges when dispatched by the ISO to consume energy to provide a service
    • Will reduce operating costs in some regions
• Large amount of flexibility given to ISOs on many points
  • ISOs can make no changes or design market rules that do not really help storage
  • Some ISOs may try to avoid a single storage asset registration type
    • Could limit dispatch flexibility, and with it resource economics
• Does not modify performance requirements for Capacity
  • Will not exempt storage from meeting the performance metrics and criteria that apply to all other resources in capacity markets
    • Won’t change Capacity Performance open-ended duration requirements, limiting access and economics
  • Will not require specific changes to minimum run-time or must-offer requirements associated with providing capacity
    • Providing capacity will be more complicated, especially for multiple-use assets
• Some market design elements remain stuck in traditional generator model
  • Declined to remove the requirement that storage have an energy schedule to provide ancillary services; simply encourages ISOs to consider removing the requirement
    • Could mean less AS opportunities and worse resource economics
  • Will not require changes to the NERC reliability standards, the associated Glossary of Terms, or regional reliability standards
    • Some ISOs may not change rules prohibiting participation, limiting access and economics for storage and other “non-synchronous” technologies
Order 841: The Bad (2)

- Does not address some distributed storage resource issues
  - Does not require allowing net injection from BTM
    - Limits market economics and with it market access
  - States it may be appropriate for distribution utilities to assess a (wholesale distribution) charge on storage resources similar to those assessed in the PJM Energy Vault proceeding
    - It would be negative to resource economics if more utilities followed ComEd’s approach
  - Storage resources cannot pay twice for charging energy - if a distribution utility can't net out wholesale from retail charging energy, the ISO can’t charge wholesale rates
    - Then a distributed storage resource might not be allowed to participate in the ISO markets
  - Energy from ISO to storage resource must be at the wholesale locational marginal price (LMP)
    - Does not seem to distinguish between front-of-meter and behind-the meter storage

- Cost of energy
  - Requires storage to pay transmission charges when it is acting as load, even if sale for resale
    - Could increase operating costs and reduce economics in some regions
  - Wholesale energy purchases should be at the applicable nodal LMP and not the zonal price
    - Some ISOs may currently allow zonal pricing, which may be lower than nodal pricing in some cases
Order 841: The TBD (1)

- Each ISO has flexibility – on participation model design:
  - Qualification criteria for storage participation model
    - Tariff language will provide clarity, but ISO discretion may exclude some storage resources
  - Whether to use its existing rules for must-offer quantities or to modify them, and
    How to treat must-offer obligations for storage that de-rates capacity to meet minimum run-time requirements
    - Need make sure must-offer obligations do not limit resource economics, including for multiple-use storage
  - How to represent the physical & operating characteristics of storage – through bidding parameters or other means, and
    What parameters are mandatory vs. optional:
    State of Charge, Minimum State of Charge, Maximum State of Charge, Minimum Charge Limit; Maximum Charge Limit, Minimum Charge Time, Maximum Charge Time, Minimum Run Time, and Maximum Run Time; and Minimum Discharge Limit, Minimum Charge Limit, Discharge Ramp Rate, and Charge Ramp Rate
    - Need see what are mandatory vs. optional parameters; attention will be needed on how ISOs plan to represent storage in software
Order 841: The TBD (2)

• Each ISO has flexibility – on energy accounting and metering:
  • To determine whether directly integrated and other ancillary / auxiliary loads are a component of charging energy or a component of station power
    • Depending on that choice, could impact projects with high thermal management needs
  • To implement metering and accounting practices as needed to address the complexities of implementing the requirements
    • Metering could be burdensome and costly
  • To offer alternatives to direct metering of storage to account for wholesale versus retail transactions
    • ISOs could either enable distributed storage or burden it with high transaction costs
    • Not clear if and how it addresses sub-metering BTM

• FERC hints at a number of potential market manipulation / market power concerns
  • While unlikely to be an issue in the near term, market monitors may raise issues in the future
Uncertainties ahead...

• There are Opportunities and Threats in the Order and in the great latitude it gives ISO in many areas

• The storage industry should get involved in the RTO/ISO compliance efforts
  • Discussions with RTO/ISO staff
  • Participation in RTO/ISO stakeholder meetings
  • Filings at FERC
  • Coordination with ESA
Requests for Rehearing

• Numerous parties (e.g., TAPS, AMP, APPA, NRECA, EEI, OMS, utilities like Xcel, etc) claim FERC cannot preempt state regulatory authority over whether and how distribution-connected resources may participate in wholesale markets
  • Seeks a clear regulatory authority to opt-out as in the Order 719 opt-out for demand response participation
  • Even if participating, seek to prohibit DER storage from providing both wholesale and retail services, given concerns over regulatory authority and/or distribution reliability
  • Wish to delay requirements for Order 841 tariff amendments until the DER issues are sorted out in the DER aggregation docket
• Other concerns:
  • More time for implementation: MISO, Xcel, APS
  • Not require transmission charges: CESA, CAISO (as CA currently exempts charging energy from Tx charges)
• Some requests for clarification on technical matters: MISO, PJM, SPP
  • Signals interests of RTOs/ISOs in diverging from compliance with Order as written
• FERC will rule on motions for rehearing week of 4/16
  • ESA and other stakeholders preparing Answers to motions
Opportunities for Storage Under FERC Order 841

PRESENTED AT:
Energy Storage Association’s Order 841 Webinar

PREPARED BY
Judy Chang
Hannes Pfeifenberger
Roger Lueken

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Authors’ Information

JUDY CHANG
Principal and Director  |  Boston, MA
Judy.Chang@brattle.com
+1.617.234.5630

JOHANNES PFEIFENBERGER
Principal  |  Boston, MA
Hannes.Pfeifenberger@brattle.com
+1.617.234.5624

ROGER LUEKEN
Associate  |  Washington, DC
Roger.Lueken@brattle.com
+1.202.419.3321

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Opportunities for Storage in RTO Markets

- Order 841 will enable storage’s participation in RTO energy, ancillary service, and capacity markets
- Extending our previous analyses of the Texas wholesale market potential suggests ~7,000 MW (20,000+ MWh) of merchant energy storage could be profitable across all U.S. RTOs
  - Assumes storage cost drops to $350/kWh (installed) with at least 3 hr duration
  - Storage built for only capturing value in the ancillary service markets will saturate
  - Previous analysis shows that up to 1,000 MW of merchant storage could be profitable in ERCOT (Texas)
- Storage’s value will increase as costs decrease and the need for flexible resources increases
  - Additional value in markets with limited flexibility and high intermittent generation

Wholesale market value is just one piece of the total storage value stack.

**Storage Value Components**

- **Customer**
  - Increased reliability (reduced outages)
  - Increased engagement in power supply
  - Retail bill savings

- **Utility Infrastructure**
  - Deferred or avoided investments in distribution and transmission infrastructure

- **Wholesale Markets**
  - Traditional value drivers: energy arbitrage, fast-response capabilities, and avoided capacity
  - Realizing additional value due to higher quality ancillary services
  - Flexibility and clean-energy products will provide additional revenue opportunities in the future
U.S.-Wide Storage Potential

Opportunities for storage could increase to 50,000 MW US-wide if all value can be captured. But this will require further action by the states.

Based on extrapolation of ERCOT market simulations and distribution system impact modeling. Does not consider specific market conditions in other regions, such as growing solar deployment, clean energy mandates, EV deployments, existing hydro storage, and continuing region-specific barriers.

1,000 MW Potential from wholesale-only participation

5,000 MW potential when all benefits can be captured

Significant Uncertainty driven by differing market fundamentals, realized storage costs, federal and state policies, and competing technologies.

Notes: Extrapolated from ERCOT study based on average 2016 system load
Questions Raised by Order 841

Stakeholders have already raised many questions in response to Order 841. A few have raised important regulatory questions, including:

- **Transmission charges** for energy used in charging storage
- **Interactions between federal and state** oversight of distributed energy storage
- **Jurisdiction over behind-the-meter storage** used for both retail and wholesale purposes
- **Responsibilities for ensuring distribution-level reliability** when distribution-connected storage’s participation in wholesale markets has implications for the distribution system
- **Metering requirements for behind-the-meter storage** participating in wholesale market

Resolving jurisdictional and control issues will be critical to unlocking the full ~50,000 MW potential for storage.
Brattle’s Storage Experience

Asset Valuation
- Valuing and sizing renewables + storage facilities
- Valuing storage across multiple value streams
- Developing bid/offer strategies to maximize value
- Accommodating storage into IRPs
- Supporting due diligence efforts of investors

Market Intelligence
- The state and federal policy landscape
- Electricity market fundamentals and opportunities
- Storage cost and technology trends
- Current and emerging business models

Policy, Regulatory, and Market Design
- Wholesale market design
- Market and regulatory barriers
- Utility ownership and operation models
- Retail rate implications of distributed storage
- Implications of storage on wholesale markets

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Additional Reading

“Getting to 50 GW? The Role of FERC Order 841, RTOs, States, and Utilities in Unlocking Storage's Potential,” Roger Lueken, Judy Chang, Johannes P. Pfeifenberger, Pablo Ruiz, and Heidi Bishop, February 22, 2018

“Battery Storage Development: Regulatory and Market Environments,” Michael Hagerty and Judy Chang, Presented to the Philadelphia Area Municipal Analyst Society, January 18, 2018

“U.S. Federal and State Regulations: Opportunities and Challenges for Electricity Storage,” Romkaew P. Broehm, Presented at BIT Congress, Inc.'s 7th World Congress of Smart Energy, November 2, 2017

“Stacked Benefits: Comprehensively Valuing Battery Storage in California,” Ryan Hledik, Roger Lueken, Colin McIntyre, and Heidi Bishop, Prepared for Eos Energy Storage, September 12, 2017

“The Hidden Battery: Opportunities in Electric Water Heating,” Ryan Hledik, Judy Chang, and Roger Lueken, Prepared for the National Rural Electric Cooperative Association (NRECA), the Natural Resources Defense Council (NRDC), and the Peak Load Management Alliance (PLMA), February 10, 2016


NEXT STEPS FORWARD
Outlook on RTO/ISO Posture

- RTO compliance filings due 12/1
- Initial assessment of RTO posture:

Topic letters and numbers correspond to Order layout

Red = likely adverse, yellow = willing but requires work, green = already comply or close

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ESA’s RTO/ISO Engagement Strategy

• ESA is planning to advocate directly in RTO/ISO stakeholder processes
• ESA is developing recommendations and strategies now

Engaging RTOs/ISOs on Order 841: Developing Recommendations and Strategies for Shaping Compliance
Q&A