New Capacity Qualification for Energy Storage Resources

Forward Capacity Market

Carissa P. Sedlacek
Director, Resource Adequacy
Disclaimer for Customer Training

ISO New England (ISO) provides training to enhance participant and stakeholder understanding. Because not all issues and requirements are addressed by the training, participants and other stakeholders should not rely solely on this training for information but should consult the effective Transmission, Markets and Services Tariff (“Tariff”) and the relevant Market Manuals, Operating Procedures and Planning Procedures (“Procedures”).

Training examples are provided for illustrative purposes only. Company names and numerical values used are fictitious.

In case of a discrepancy between training provided by ISO and the Tariff or Procedures, the meaning of the Tariff and Procedures shall govern.
Objectives

Today’s focus is on Forward Capacity Market (FCM) participation. At the end of this training you will be able to:

• Recall how energy storage can participate in the FCM as a generator or demand capacity resource
• List basic FCM participation requirements
• Review energy storage interconnection procedures and examples
• Recognize some common pitfalls to participation in FCM
• Find additional information

Project sponsors are encouraged to contact Customer Support prior to beginning FCM new capacity qualification process.
Topics NOT Covered Today

• Other wholesale electricity markets and how to participate in them
• Market registration requirements
## Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>alternating current</td>
<td>MVAR</td>
<td>megavolt ampere reactive</td>
</tr>
<tr>
<td>ADCR</td>
<td>active demand capacity resource</td>
<td>MW</td>
<td>megawatt</td>
</tr>
<tr>
<td>AVR</td>
<td>automatic voltage regulation</td>
<td>MWh</td>
<td>megawatt-hour</td>
</tr>
<tr>
<td>CCP</td>
<td>capacity commitment period</td>
<td>OP</td>
<td>operating procedure</td>
</tr>
<tr>
<td>DC</td>
<td>direct current</td>
<td>pnode</td>
<td>pricing node</td>
</tr>
<tr>
<td>DCR</td>
<td>demand capacity resource</td>
<td>PRD</td>
<td>price-responsive demand</td>
</tr>
<tr>
<td>FCA</td>
<td>Forward Capacity Auction</td>
<td>PTF</td>
<td>pool transmission facility</td>
</tr>
<tr>
<td>FCM</td>
<td>Forward Capacity Market</td>
<td>PURPA</td>
<td>Public Utility Regulatory Policies Act</td>
</tr>
<tr>
<td>FERC</td>
<td>Federal Energy Regulatory Commission</td>
<td>RDP</td>
<td>retail delivery point</td>
</tr>
<tr>
<td>kW</td>
<td>kilowatt</td>
<td>RQM</td>
<td>revenue quality meter</td>
</tr>
<tr>
<td>MR1</td>
<td>Market Rule 1 (i.e., Section III of ISO-NE Tariff)</td>
<td>SOI</td>
<td>show of interest</td>
</tr>
</tbody>
</table>
Market Rule References

• **Market Rule 1 (MR1)**, Section III.13.1, *Forward Capacity Auction Qualification*, defines the qualification process and is the foundation for slides within this presentation.

• Market Rule 1 is Section III of *ISO New England Inc. Transmission, Markets, and Services Tariff*.
Forward Capacity Market Participation
Energy Storage Resources Background

• Unique because many such technologies operate both as supply and load resource
• ISO market rules offer very flexible framework to accommodate this unique operating capacity
  – Can participate in wholesale markets in various combinations
    • Energy storage facility’s ability to sustain output may affect participation in Forward Capacity Market and other markets
Supply Resources Types

• **Intermittent generating resources**
  – For example, wind, solar, run-of-river hydro, and other renewable resources
  – Output defined over reliability hours

• **Non-intermittent generating resources**
  – For example, oil, coal, natural gas, nuclear, energy storage, and other resources
## Demand Capacity Resource Types

<table>
<thead>
<tr>
<th>Passive (On-peak and seasonal peak)</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Defined at load zone level</td>
<td>• Defined at dispatch zone level</td>
</tr>
<tr>
<td>• Reduce energy demand (MW) during peak hours</td>
<td>• Reduce energy demand (MW) during reliability hours</td>
</tr>
<tr>
<td>• Are non-dispatchable</td>
<td>• Operate based on real-time system conditions via dispatch by ISO (dispatchable)</td>
</tr>
</tbody>
</table>

![Passive Resource](image1.png)

![Active Resource](image2.png)
Overview of Storage Participation

• Ways energy storage can participate in FCM are defined by proposed project’s:
  – Characteristics
  – Interconnection plan
    • Required whether seeking qualification as generator or demand capacity resource
• Proposed projects must follow same FCM requirements applicable to all technologies
## Project Characteristics

**Project sponsors must identify project characteristics, such as:**

<table>
<thead>
<tr>
<th>Interconnection Characteristics</th>
<th>Operational Dispatch Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interconnection request with local transmission owner or with ISO</td>
<td>• Charging configuration (from power grid, co-located facility, or both)</td>
</tr>
<tr>
<td>• Location (pnode or point of interconnection)</td>
<td>• MWh charge capability</td>
</tr>
<tr>
<td>• Proof of site control</td>
<td>• MWh discharge capability</td>
</tr>
<tr>
<td>• One-line diagram with metering configuration</td>
<td>• Charge and discharge rates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size</th>
<th>Rights to Capacity Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>• AC and DC MW ratings of all components</td>
<td>• Project sponsor must be able to demonstrate rights to capacity output (e.g., contract, interconnection agreement, net metering agreement)</td>
</tr>
<tr>
<td>• Inverter and/or collector losses</td>
<td></td>
</tr>
</tbody>
</table>
Facility Size and Resource Type

- Facility must be qualified at ≥100 kW
- Participant chooses to submit show of interest as either:
  - Generator
    - ISO-NE interconnection process (i.e., bulk power system)
    - State interconnection process (i.e., distribution system)
  - Demand capacity resource
    - Active
    - Passive

MR 1, Section III.13
Interconnection Process

• New energy storage seeking to participate as generating capacity resource must start with interconnection

• Before pursuing FCM qualification, project must have a valid interconnection request/application, regardless of jurisdiction
  – If required to follow ISO New England interconnection process:
    • Must have at least valid interconnection request and queue position
    • Projects that have not completed feasibility study will be subject to additional analysis during FCM qualification
  – Some facilities must follow state interconnection process, instead

Per FERC Order No. 2003-A, “Facilities subject to the [open access transmission tariff] are: transmission facilities used to transmit electric energy in interstate commerce either at wholesale or for unbundled retail sales; and ‘distribution’ facilities that are used for wholesale sales in interstate commerce.”
ISO New England vs. State Interconnection Process Overview

1. Is project interconnecting to ISO-administered transmission system (pool transmission facility [PTF], non-PTF, and FERC-jurisdictional distribution)?
   - If YES, see #2
   - If NO, use state interconnection process
     • Contact interconnecting transmission owner

2. Is project exempt?

   Exemptions:
   • Retail customer interconnecting new generating facility whose energy will ONLY be consumed at retail customer’s site
   • New generating facility connected to distribution facility subject to ISO tariff, IF generating facility will not be used to make wholesale sales of electricity in interstate commerce
   • Qualifying facility defined by PURPA, where facility’s owner intends to sell all output to its interconnected electric utility

   - If YES, use state interconnection process
   - If NO, use ISO interconnection process
     • See ISO’s New or Modified Interconnections webpage

For details, see Distribution-Connected Generation Guidance presentation
Co-Located Facilities

• Energy storage facilities **must qualify as separate FCM resources** and register as **separate assets** (see exceptions below)
  - Helps manage dispatch in system operations, maintain system reliability, and avoid double-counting
    • Double-counting can occur when an active demand capacity resource and a <5 MW generator exist at same location

• Exceptions:
  1. Multiple energy storage assets behind single retail delivery point can map to single demand capacity resource
  2. Co-located facilities that are **<5 MW** can participate as single FCM generating resource

**Example:** Storage may be co-located with solar facility, but generally they must be submitted as multiple FCM resources
Operational Considerations

• Metering and real-time operational telemetry requirements must be met, consistent with applicable requirements for ISO-NE operating procedures (OPs):
  – No. 14 (OP 14): Technical Requirements For Generators, Demand Capacity Resources, Asset Related Demands, and Alternative Technology Regulation Resources
  – No. 18 (OP 18): Metering and Telemetering Criteria

• If battery facility and co-located solar or wind facility are qualifying and registering as separate assets, each generator asset must be able to provide separate metering and real-time telemetry data to ISO, including:
  – MW/MVAR output
  – Status of facility breaker(s)
  – Automatic voltage regulation (AVR) status
Interconnection Configuration Examples
### Summary of Potential FCM Qualification Options

Storage technologies participate in FCM like other resources

<table>
<thead>
<tr>
<th>RESOURCE CHARACTERISTICS</th>
<th>Generator</th>
<th>Dispatchable Demand Capacity Resource (Active)</th>
<th>Non-Dispatchable Demand Capacity Resource (Passive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected to Transmission System</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Connected to Distribution System</td>
<td>Yes</td>
<td>Behind retail delivery point (RDP)</td>
<td>Behind retail delivery point (RDP)</td>
</tr>
<tr>
<td>Co-Located with Another FCM Resource</td>
<td>Yes, as &lt;5 MW generator (example #3)</td>
<td>Separate resource (only one demand response asset at the RDP)*</td>
<td>Separate resource or map to existing resource of same capacity type</td>
</tr>
<tr>
<td>Capacity Resource Type</td>
<td>Non-intermittent generator (example #1) or intermittent generator (example #3)</td>
<td>Active demand-capacity resource</td>
<td>On-peak or seasonal peak resource (passive demand capacity resource)</td>
</tr>
</tbody>
</table>

**Examples**

<table>
<thead>
<tr>
<th>Single Asset at Facility</th>
<th>#1</th>
<th>#4</th>
<th>#4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-Located Asset at Facility</td>
<td>#2, 3</td>
<td>#5</td>
<td>#6</td>
</tr>
</tbody>
</table>

*Under Price Responsive Demand (PRD), only one demand response asset can be located behind a single retail delivery point. Therefore, two or more active demand response assets cannot be co-located behind a single retail delivery point.*
Overview of Common Examples

#1: Non-intermittent storage connected to power grid as generator

#2: Co-location with storage technology as generator

#3: Co-location as <5 MW generator

#4a: Passive (on-peak) storage resource at single facility

#4b: Active storage resource at single facility

#5a: Co-location of single passive resource at single facility

#5b: Co-location of two passive resources at single facility

#6: Co-located active demand capacity resource
Example #1: Non-Intermittent Storage Technology Connected Directly to Power Grid as Generator

- Interconnection rights must be established regardless of whether project is located behind meter (i.e., is <5 MW generator)
- Qualified capacity = battery’s net continuously maintainable discharge capability over relevant audit duration
  - Battery asset type is “Energy Storage (Excludes Pumped Storage)”
    - Two-hour audit duration for Establish Claimed Capability and Seasonal Claimed Capability
    - Summer value measured at 90°F
    - Winter value measured at 20°F
    - Qualified capacity not affected by battery’s charging cycle
Example #2: Co-Location at Solar Facility with Storage Technology as Generator*

- Each resource has:
  - Separate interconnection rights and separate qualified capacities
  - Each asset must meet metering and real-time telemetry requirements (OPs 14, 18)
    • A revenue quality meter (RQM) for wholesale market settlement
      - RQM reads used to verify capability of asset and overlying FCM resource
- Battery
  - Non-intermittent resource qualification
  - Qualified capacity = battery’s net continuously maintainable discharge capability over relevant audit duration
    • Battery asset type is “Energy Storage (Excludes Pumped Storage)"
    • Two-hour audit duration for Establish Claimed Capability and Seasonal Claimed Capability
      - Summer value measured at 90°F; winter value measured at 20°F
    • Qualified capacity not affected by battery’s charging cycle
- Solar Facility
  - Intermittent resource qualification
  - Qualified capacity = resource’s median net output over reliability hours for:
    • Summer: Hours Ending 1400–1800; winter: Hours Ending 1800–1900

*Same applies to co-locating with wind or any intermittent generator
Example #3: Co-Location at Solar Facility with Storage Technology as <5 MW Generator*

- Interconnection rights generally established with interconnecting transmission owner
  - May have separate interconnection agreements for solar and battery
- Preferred configuration is as single market participant
  - May be one asset representing one FCM resource if allowed by supporting solar/battery qualification data
    - Qualified capacity would be combination of solar and battery’s net continuously maintainable discharge capability over audit duration, which is median net output over reliability hours for:
      - Summer: hours ending 1400–1800; winter: hours ending 1800–1900
- Co-located solar and storage facilities may share common inverter
- Single revenue quality meter at host facility load (retail delivery point) needed for wholesale market settlement
  - Used to verify capability of asset and FCM resource
- Intermittent resource qualification
  - Qualified capacity depends on design: relative size of battery, panels/wind production, and whether inverter will limit operation of facility

*Same applies to co-locating with wind or any intermittent generator
Example #4: Storage Technology as Passive or Active Demand Capacity Resource (DCR) at Single Facility

**Passive (On-Peak) Resource**

- Interconnection rights established with interconnecting transmission owner
- Battery must have:
  - Separate RQM
  - RQM at host facility load (retail delivery point)
- **Passive** demand capacity resource installation date must be after existing capacity qualification deadline for capacity commitment period for which unit is seeking qualification
- Upon registration, facility’s net supply capability is less than the greater of either:
  - 5 MW
  - Maximum facility load

---

**Active Resource**

- RQM 1
- Inverter
- Load Asset
- Demand Response Asset (Battery)
- Demand Response Resource (DRR)
Example #5: Co-Locating Storage Technology with Solar Facility as Passive Demand Capacity Resource*

- Preferred configuration is as single market participant
- Interconnection rights established with interconnecting transmission owner
- Unit installation date must be after existing capacity qualification deadline for capacity commitment period for which unit is seeking qualification
- Both battery and solar must have:
  - Separate RQMs
  - RQM at host facility load (retail delivery point)
- Upon registration, facility’s net supply capability is less than the greater of either:
  - 5 MW
  - Maximum facility load

*Same applies to co-locating with wind or any intermittent generator
Example #6: Co-Locating Storage Technology at Solar Facility as Active Demand Capacity Resource*

- Preferred configuration is as single market participant
- Interconnection rights established with interconnecting transmission owner
- Both battery and solar must have:
  - Separate RQMs
  - RQM at host facility load (retail delivery point)
    - Only one demand response asset can be located behind a single retail delivery point
    - See Price Responsive Demand Project customer readiness page for requirements to participate in energy market
- Upon registration, facility’s net supply capability is less than the greater of either:
  - 5 MW
  - Maximum facility load

*Same applies to co-locating with wind or any intermittent generator
Potential Pitfalls of FCM Qualification

For Battery Storage Projects
Pitfall Case #1

Insufficient documentation demonstrating that project sponsor has site control or ownership of (or contract for) megawatt output of storage facility

• Disqualification reasoning for Massachusetts battery storage project:

  “The project sponsor has not demonstrated that it is entitled to qualify and own the capacity for the aforementioned project. Under the Massachusetts Department of Public Utilities regulations for net-energy metering, Distribution Companies may elect to seek to obtain capacity payments through the FCM for the electricity generated by Class II and III Net Metering Facilities by asserting title to the capacity products within 30 days of the filing of Schedule Z by the Host Customer.”

Show of interest submission must clearly demonstrate that project sponsor holds MW capacity rights and physical control of facility
Pitfall Case #2

Project one-line diagram did not provide adequate depiction of storage interconnection design, including point of interconnection and metering configuration

• Disqualification reasoning for an inappropriate interconnection plan:

“The one-line diagram for the proposed battery storage project is depicted as being behind the same revenue meter as the proposed co-located solar facility project. As described in Section IV of Operating Procedure No. 18 (“OP-18”) – Metering and Telemetering Criteria, in order for an asset to be eligible to participate in one of more of the markets the asset must have watt-hour metering as defined in OP-18. The one-line diagram provided did not establish that the battery storage project has its own revenue quality meter for wholesale market settlement, but rather is relying on the metering designated for the proposed co-located solar facility project. This metering design is not acceptable for participation in the New England markets.”

Show of interest submission (namely, one-line diagram) must clearly detail facility’s point of interconnection with existing transmission/distribution system and metering configuration
Pitfall Case #3

Co-located facility’s **interconnection request** does not reflect presence of storage facility

- Disqualification reasoning for an inappropriate interconnection request:

  “The interconnection request for the proposed battery storage project only makes mention of the co-located photovoltaic facility and does not make mention of the proposed battery storage facility. The submitted interconnection request does not support participation of the proposed battery storage project in the Forward Capacity Market.”

Interconnection request **must** identify battery storage resource in order for it to qualify for FCM
Summary

In this training, we reviewed:

• How energy storage can participate in Forward Capacity Market as generator or demand capacity resource
• Basic FCM participation requirements
• Energy storage interconnection procedures and examples
• Some common pitfalls to participation in FCM
Additional Resources
Learn How to Submit a Show of Interest

• Visit [ISO Upcoming Courses page](#) to sign up for learning opportunities

• Browse [FCM materials on ISO Training Materials page](#) to see recordings and slides from past webinars

• Look for:
  – [FCM Show of Interest for New Generation and Imports](#)
  – [FCM Show of Interest for New Demand Capacity Resources](#)
More FCM Resources

- Markets and Operations > Markets Data and Information > Forward Capacity Market
  http://www.iso-ne.com/markets-operations/markets/forward-capacity-market
- Markets and Operations > Markets Data and Information > Forward Capacity Market > FCM Participation Guide
- Participate > Rules and Procedures
  http://www.iso-ne.com/participate/rules-procedures
- Participate > Rules and Procedures > Planning Procedures
  http://www.iso-ne.com/participate/rules-procedures/planning-procedures
- Participate > Applications and Status Changes > New Customer Registration
  http://www.iso-ne.com/participate/applications-status-changes/new-registration
- Participate > Applications and Status Changes > Financial Assurance and Credit
  http://www.iso-ne.com/participate/applications-status-changes/financial-assurance-credit
- Participate > Support > Customer Readiness 12-Month Outlook
  https://www.iso-ne.com/participate/support/customer-readiness-outlook
- System Planning > Transmission Planning > Interconnection Request Queue
  http://www.iso-ne.com/system-planning/transmission-planning/interconnection-request-queue
Learn About Other Energy Storage Participation Options

• **Energy Storage Market Participation Overview**
  - Webinar recording
  - Presentation slides

• **Continuous Storage Facility Participation**
  - Available on [Training Materials webpage](#) late February 2019

• Interconnection guidance:
  - ISO’s [Distribution-Connected Generation Guidance](#) presentation
  - [IEEE Standard 1547](#), *Standard for Distributed Resources Interconnected with the Electric Power Systems*
Customer Support Information

**Ask ISO** (preferred)

- Self-service interface for submitting inquiries
- Recommended browsers are Google Chrome and Mozilla Firefox
- For more information, see the [Ask ISO User Guide](#)

<table>
<thead>
<tr>
<th>Method</th>
<th>Contact Information</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email</td>
<td><a href="mailto:custserv@iso-ne.com">custserv@iso-ne.com</a></td>
<td>Anytime</td>
</tr>
<tr>
<td>Phone*</td>
<td>(413) 540-4220</td>
<td>Monday through Friday 8:00 a.m. to 5:00 p.m. (EST)</td>
</tr>
<tr>
<td>Pager</td>
<td>(877) 226-4814</td>
<td>Outside of regular business hours</td>
</tr>
<tr>
<td>Pager (emergency inquiries)</td>
<td>(877) 226-4814</td>
<td></td>
</tr>
</tbody>
</table>

*Recorded/monitored conversations*
Thank You