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Independent System Operator

Hybrid Storage Model : Market Design Overview

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WebEx

Agenda

- Project background
- Market Design Overview
- Energy Market Design Overview
- Capacity Market Design Overview
- Next Steps
- Project Timeline

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Discussion goals

- Present proposal on participation options for Hybrid Storage Resources (HSRs)
- Solicit feedback on these participation options to understand which option(s) best aligns with business needs.

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Project Background

Background: A Grid in Transition

- **The NYISO's wholesale markets can serve as an effective platform for achieving New York State environmental objectives**
  - Through active engagement with stakeholders and policymakers, the NYISO is developing design improvements to meet the future challenges expected to arise with high levels of intermittent renewable and distributed energy resources
- **The plan includes a set of market design enhancements that work together coherently and efficiently to satisfy New York's changing grid reliability needs**
  - The Hybrid Storage Model project will help enable climate policies while also supporting grid reliability

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Project Scope

- **This project seeks to explore market participation option(s) for large paired/co-located front-of-the-meter generators and energy storage resources (i.e. Hybrid Storage Resources)**
  - Incentives along with improvements in flexibility and availability are motivating developers to couple generation resources with storage resources
- **If modifications to existing market rules are required, these will be developed for a potential vote at the BIC by the end of 2020**
  - It is reasonable to expect that the design could be multifaceted, where some elements of the design are advanced faster than others

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Market Design Overview

Definitions

- **Hybrid Storage Resource (HSR): A combination of front-of-the-meter generation and energy storage assets physically located behind a single Point of Interconnection (POI)**
- **Other definitions:**
  - **Injection limit:** This is the maximum output that an HSR can inject into the grid
  - **Point of Interconnection (POI):** Point where the HSR facility interconnects on the distribution or transmission system

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Design Principles

- To ensure faster design and implementation, the NYISO proposes that an HSR participate under existing market models, to the extent possible. This may necessitate minor modifications to existing market rules, but allow for quicker implementation
- Allow resource components within the HSR to share the Point of Interconnection (POI)
- Accommodate different HSR configurations:
  - Charging/No – charging option from grid for storage component(s)
  - Both AC and DC coupling configuration between Intermittent Power Resources (IPRs) and Energy Storage Resources (ESRs)

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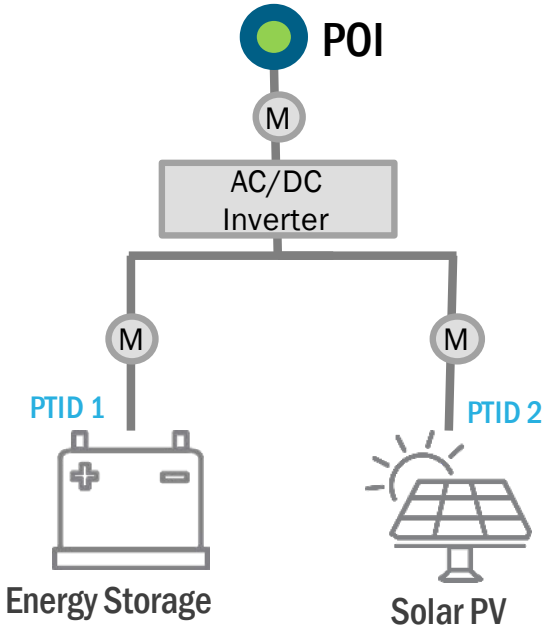
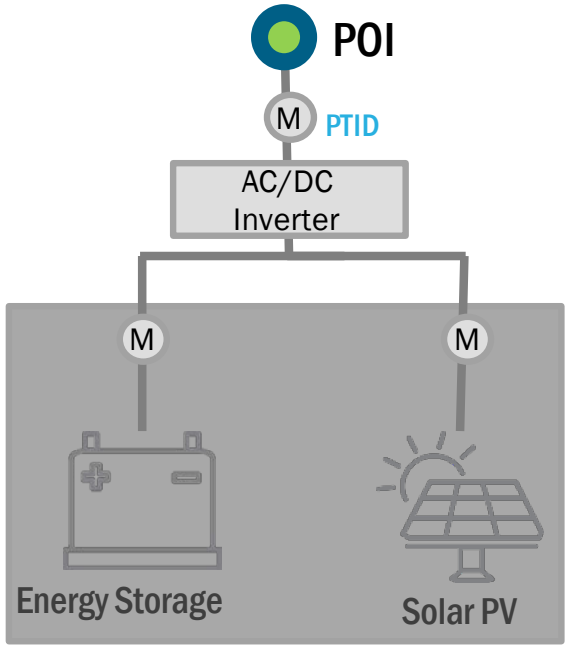
HSR Participation options under consideration

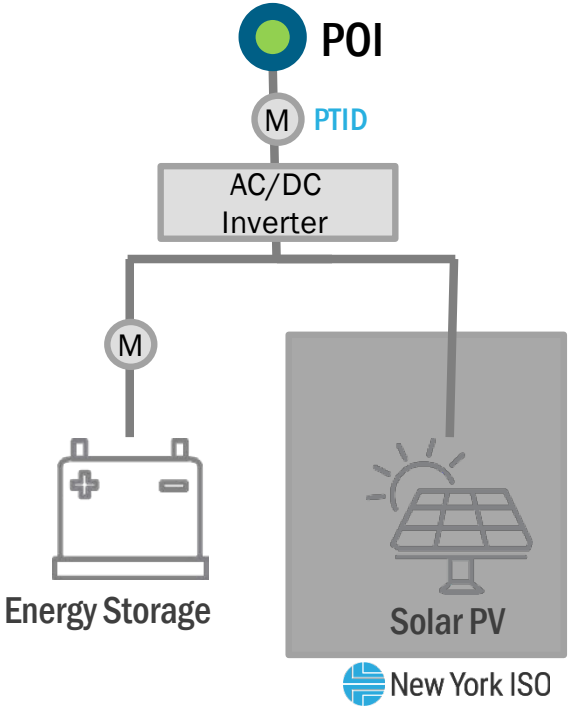
Option 1: As distinct generators



Option 2: As an aggregation behind the same POI



Option 3: As a self-managed ESR



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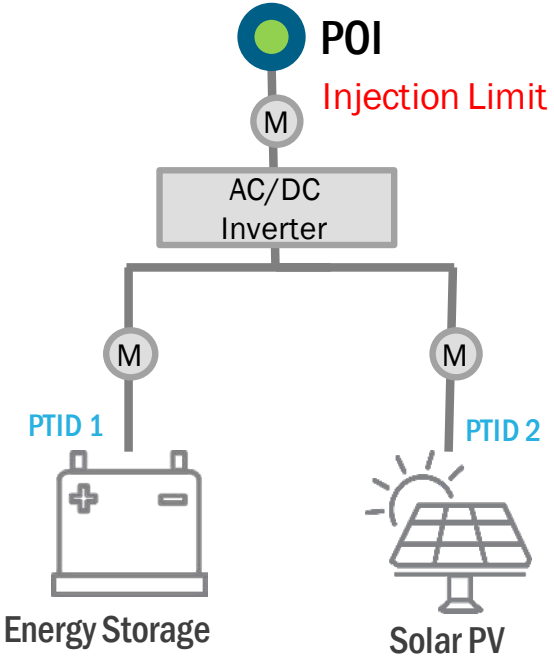
Energy Market Design Overview

Participation Option 1: As distinct generators

Participation Option 1: Overview

- This model is currently available, treating each resource as a distinct generator
- Each resource component within a hybrid project will have a distinct PTID/bid/schedule/settlement
- Each component will participate under its own participation model. In this example, Solar PV will participate as an Intermittent Power resource (IPR) and Energy Storage Resource (ESR) will participate under the ESR model
  - Only the ESR component will be eligible to provide reserves and regulation
- To participate in this model, the injection limit of the HSR project must be equal to or greater than the combined capability of all resources within the project



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Potential Enhancements to Option 1

- Currently evaluating potential enhancements that would enable this option to accommodate HSR projects with an injection limit that is less than the combined capability of its component resources

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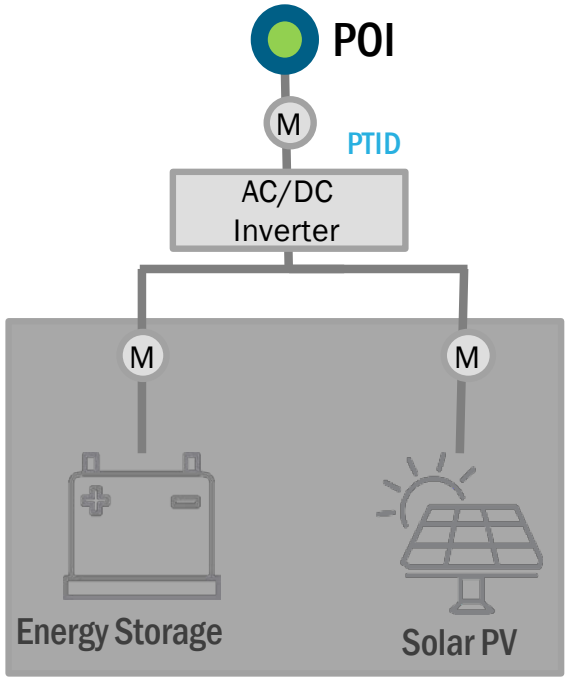
Participation Option 2: As an aggregation behind the same POI

Participation Option 2: Overview

- There will be one PTID, one bid and one schedule for the combined resources within the HSR
- HSR will be subjected to same energy market participation rules, as applicable to a DER (Distributed Energy Resource) aggregation, with these changes
  - There will be no 20MW size limit for individual resource components
  - All components will be required to be behind the same POI
- Under this option, an HSR comprising of a combination of IPR(s) and ESR(s) will not be eligible to provide reserves and regulation
- NYISO expects it would be able to support this option in 2021, following deployment of the DER model



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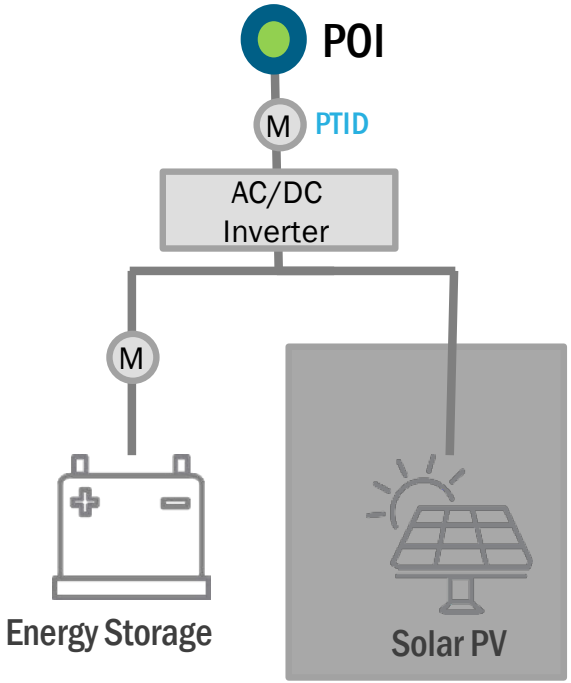
Participation Option 3: As a self-managed ESR

Participation Option 3: Overview

- There will be one PTID, one bid and one schedule for the combined resources within the HSR
- HSR will be subjected to same energy market participation rules, that apply to an ESR(s) with a Self-Managed Energy Level
  - ISO will see the hybrid project as an ESR with Self-Managed Energy Level; maximum capability will be limited to the capability of the ESR component(s)
- Under this option, an HSR comprised of a combination of IPR(s) and ESR(s) will be eligible to provide reserves and regulation
  - Energy, reserve and regulation schedule will be limited by the State of Charge of ESR component(s)
- NYISO expects it would be able to support this option in 2021, following deployment of the ESR model



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Capacity Market Design Overview

Existing Capacity Obligations

Existing Capacity Obligations

- The following slides summarize key obligations for capacity suppliers in existing models, which may inform the NYISO's proposed Hybrid Storage Resource structures

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Existing Capacity Obligations for Energy Storage Resources (ESR)

- **Capacity Resource Interconnection Service (CRIS)**
  - CRIS is awarded for injection capability only
- **Demonstrated Maximum Net Capability (DMNC)**
  - Either 1 or 4-hour test based on ESR technology type
    - Energy Duration Limitations (EDL) may also impact the testing requirement
      - For more information about duration categories, see the April 2019 BIC presentation: https://www.nyiso.com/documents/20142/6006612/BIC%20DER%20Market%20Design%20Presentation.pdf/9cdc8700-ab90-d741-c28d-0c29b3468807
  - Test must occur during the Peak Load Window (PLW) if EDL
- **Bid/Schedule/Notify (B/S/N)**
  - Must B/S/N into the Day-Ahead Market (DAM) during all hours of PLW if EDL
    - If not EDL, the resource must B/S/N into the DAM for all hours, consistent with traditional generator requirements

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Existing Capacity Obligations for Distributed Energy Resources (DER)

- **Capacity Resource Interconnection Service (CRIS)**
  - Single CRIS value for entire facility, for injection capability only
- **Demonstrated Maximum Net Capability (DMNC)**
  - 6-hour test (or length of EDL)
    - Once grid penetration of EDL resources reaches 1,000MW, the default test duration will increase to 8 hours
    - For more information about duration categories, see the April 2019 BIC presentation: https://www.nyiso.com/documents/20142/6006612/BIC%20DER%20Market%20Design%20Presentation.pdf/9cdc8700-ab90-d741-c28d-0c29b3468807
- **Bid/Schedule/Notify (B/S/N)**
  - If EDL, must B/S/N into the DAM for consecutive number of hours corresponding to EDL
    - If not EDL, the resource must B/S/N into the DAM for all hours, consistent with traditional generator requirements

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Existing Capacity Obligations for Intermittent Power Resources (IPR)

- **Capacity Resource Interconnection Service (CRIS)**
  - Traditional evaluation process based on deliverability to grid
- **Demonstrated Maximum Net Capability (DMNC)**
  - Nameplate
- **Bid/Schedule/Notify (B/S/N)**
  - No Obligation

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Proposed HSR ICAP and UCAP Calculations

ICAP and UCAP for HSR under Participation Option 1

- **Using the currently available participation models, the NYISO proposes that ICAP and UCAP for each resource component under Option 1 be calculated based on the existing method applicable to that resource type**
  - UCAP is calculated using the availability-based method for ESRs
  - UCAP is calculated using the performance-based method for IPRs
    - Additional detail regarding existing methods for ICAP and UCAP calculations is provided in the Appendix

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ICAP and UCAP for HSR under Participation Option 2

- **The NYISO proposes to calculate ICAP and UCAP under Option 2 using the availability-based method, consistent with existing DER rules**
  - The UOL of the entire HSR would be used to measure availability
    - Additional detail about the DER ICAP and UCAP calculations is provided in the Appendix

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ICAP and UCAP for HSR under Participation Option 3

- **The NYISO proposes to calculate ICAP and UCAP using the availability-based method under this option, consistent with existing ESR rules**
  - The UOL of the ESR asset within the HSR would be used to measure availability
    - Additional detail about the ESR ICAP and UCAP calculations is provided in the Appendix

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Next Steps and Timeline

Next Steps

- **NYISO seeks stakeholder feedback and will continue discussions with HSR developers to understand which option(s) best align with business needs**
  - This will inform which participation option will best align with HSR developer business needs and should be pursued as part of the NYISO's project proposal
- **Based on feedback received from stakeholders and developers, NYISO will bring more details on the HSR participation rules to future stakeholder discussions.**

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Planned Timeline

- **Q2 2020**
  - Continue discussions on market participation concepts for hybrid storage resources
  - Present Market Design Concept Proposal to stakeholders
- **Q3 2020**
  - Present consumer impact analysis to stakeholders
  - Present Market Design Complete to stakeholders

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Questions?

Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system

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Appendix

ICAP/UCAP Calculations in Existing Models

- **For conventional generators, the existing ICAP and UCAP calculations are as follows:**
  - ICAP = min(CRIS, DMNC)
  - Adjusted ICAP = ICAP * Duration Adjustment Factor[1]
  - UCAP = Adjusted ICAP * (1 – GADS Derating Factor)
- **For Intermittent Power Resources, the existing ICAP and UCAP calculations are as follows:**
  - ICAP = Min (Nameplate Capacity, CRIS)
  - Adjusted ICAP = ICAP * Duration Adjustment Factor[2]
  - UCAP = Adjusted ICAP * Production Factor
    - The Production Factor is based on operating data for the Prior Equivalent Capability Period
    - This calculation weights performance during Peak Hours

1. It is to be noted that the Duration Adjustment Factor is 100% for non-duration limited resources
2. Intermittent Power Resources have a Duration Adjustment Factor of 100% as they are not eligible to be a Duration Limited Resources

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ICAP/UCAP Calculations in Existing Models cont'd

- **For Energy Storage Resources, the existing ICAP and UCAP calculations are as follows[1]:**
  - ICAP = min(CRIS, DMNC)
  - Adjusted ICAP = ICAP * Duration Adjustment Factor[2]
  - UCAP = Adjusted ICAP * (1 – Derating Factor)
    - ESR UCAP is calculated using the NYISO availability calculation
      - Availability-based derating factors are calculated using a time-weighted UOL availability evaluated against the ICAP sold
        - » Derating Factor = 1 – Availability Factor

1. Target implementation for ESR is Q3 2020
2. It is to be noted that the Duration Adjustment Factor is 100% for non-duration limited resources

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ICAP/UCAP Calculations in Existing Models cont'd

- **For injection Distributed Energy Resources, the existing ICAP and UCAP calculations are as follows[1]:**
  - $ICAP = \min(CRIS_{Injection}, DMNC_{Injection}) + DMNC_{Load\ Curtailment}$
  - $Adjusted\ ICAP = ICAP * Duration\ Adjustment\ Factor$[2]
  - $UCAP = Adjusted\ ICAP * (1 - Derating\ Factor)$
    - DER UCAP is calculated using the NYISO availability calculation
      - Availability-based derating factors are calculated using a time-weighted UOL availability evaluated against the ICAP sold
        - » Derating Factor = 1 –Availability Factor

1. Target implementation for DER is Q4 2021
2. It is to be noted that the Duration Adjustment Factor is 100% for non-duration limited resources

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